Chapter 6 GROUND WATER MONITORING & ASSESSMENTS

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Section 6-1 OVERVIEW

Public interest in ground water focuses primarily on its use as a drinking water supply for humans and livestock and as a source of process water for industry. More than 60% of Maine households draw their drinking water from ground water supplied by private or public wells, or springs. Ground water is the source of approximately 90% of all the water used by households with individual supplies. In addition, nearly 75% of the water needed for Maine livestock is provided by ground water. Over 80% of the ground water withdrawn from aquifers in the state is used for private or public drinking water. In contrast, ground water used for industrial purposes is only 11% of the total volume withdrawn for all purposes. Federal requirements for surface water treatment are a driving force behind the shift to ground water use for public water supplies.

Generally, the ground water supply in Maine is adequate. The total withdrawal of ground water by all water users is less than one percent of the annual ground water recharge each year. The remaining annual ground water recharge is lost through evapotranspiration or discharges to ponds, lakes, rivers, and streams. Seasonal variations in water tables can lead to local ground water shortages. The Maine Drought Task Force (convened by the Maine Emergency Management Agency) publishes information on Maine ground water and surface water levels at the following website: www.maine.gov/mema/drought

Ground water is withdrawn from three basic types of aquifers in Maine: unconsolidated glaciofluvial deposits (stratified drift or sand and gravel aquifers), till, and fractured bedrock. The stratified drift deposits are the most favorable for development of large volume water supply wells, but these deposits are limited in size and distribution (less than about 10% of the state). The largest ground water withdrawals were in the Lower Kennebec, Lower Penobscot, Presumpscot, and Lower Androscoggin River basins (USGS 1995 figures). These areas contain major sand and gravel aquifers, and water demand is high due to the heaviest concentration of people and businesses. Discontinuous bedrock aquifers underlie the entire state and are used for domestic, commercial, industrial and agricultural purposes, and for small public supplies such as schools, restaurants, and summer camps. Wells in till do not generally yield large quantities of water and are most often used for individual domestic water supplies.

A significant portion of Maine's ground water may be threatened by contamination, particularly in unforested areas (approximately 11% of the State). Numerous wells in Maine have been made unpotable by pollution from specific point sources and also nonpoint source pollution. As public concern about ground water quality increases, more widespread monitoring and detection of contamination is expected. The Maine Environmental Priorities Project identified drinking water quality, including private and public well supplies, as a high risk issue ("Report from the Steering Committee, Consensus Ranking of Environmental Risks Facing Maine", January, 1996). Because of slow ground water flow rates and low biological activity, ground water contaminants are extremely persistent. Centuries may be required for natural processes to restore some contaminated ground water to potable standards.

Major impediments to effective ground water protection in Maine are (1) absence of a complete ground water quality database to assess the extent of degradation, (2) lack of data to quantify the impact of some nonpoint pollution sources, (3) inadequate State and Federal funding for ground water research and protection programs and (4) general public unfamiliarity with key ground water concepts and issues. Public misconception about ground water is probably the major factor contributing to degradation of this resource. Maine will continue to work with the USEPA to address these issues through Maine's Source Water Protection Program and other initiatives.

Section 6-2 ASSESSMENT OF GROUND WATER QUALITY

In Maine, ground water is classified by its suitability for drinking water purposes. Under the Maine Water Classification Program, ground water is classified as either potable (GW-A) or unpotable (GW-B). Water is unpotable when the concentrations of chemical compounds detected exceed either the Maximum Contaminant Levels (MCL) or the Maximum Exposure Guidelines (MEG) as defined in the Rules Relating to Drinking Water administered by the Maine Department of Human Services (DHS). Although there are many localities where ground water is unpotable and highly contaminated, no ground water is currently classified GW-B. The state is not currently attempting to designate non-attainment areas.

Detailed quantitative estimates of the statewide extent of ground water contamination are not currently available. In addition, current information about ground water contamination in Maine does not necessarily portray the situation accurately. This information reflects contaminants that have been looked for, where they have been looked for, and where they have been found. Further, the number of wells contaminated by a specific pollution activity does not necessarily reflect its overall ground water pollution potential since some activities (e.g. agriculture) occur in sparsely populated areas with few available wells to monitor.

Ground Water Monitoring

Monitoring of ground water in Maine is either site-specific or generalized. Monitoring at a particular site is typically done to gather data on water quality impacts of particular activities, and may or may not be research-related. Most of the ground water data collected in Maine is the result of permit conditions, enforcement agreements or impact assessments. Sources of this information are scattered in a number of state agencies including: the DEP Bureau of Land and Water Quality and DEP Bureau of Remediation and Waste Management; the Department of Transportation (DOT), Water Resources and Hazardous Waste Section; the Department of Human Services (DHS), Division of Health Engineering - Drinking Water Program, the DHS Environmental Health Unit, the DHS Health and Environmental Testing Laboratory; and the Department of Agriculture (Office of Agriculture, Food and Rural Resources, Board of Pesticide Control (BPC)). Other information is collected by the Department of Conservation, the Maine Geological Survey (MGS) and the U. S. Geological Survey (USGS). These datasets are stored on paper or in digital computer files. With the advent of the Environmental Groundwater Analysis Database (EGAD), many of these digital datasets that have been collected by or stored at the DEP are now readily available to the public or other agencies in either report or map form. The creation of new EGAD "backend" functions have also allowed users to easily link specific site information to associated water test results. This effort has greatly enhanced the DEP's ability to communicate and report ground water data to the EPA and other state and federal agencies.

Ambient monitoring refers to large area, long-term monitoring conducted to obtain trend information on ground water quality or quantity. The MGS and the USGS carry out these types of monitoring projects under several cooperative agreements. The USGS and MGS maintain a statewide network of ground water observation wells to track changes in water quality and quantity. The datasets thus derived are incorporated into both maps and reports and have proven invaluable to local planning boards and to State efforts such as the registration of underground oil storage tanks and site reviews of various land use proposals. For the purpose of this report, data derived from the DHS Public Water Supply Monitoring Program are used as ambient ground water quality data. These water tests are from single-source untreated public water supply wells.

Within the DEP, site-specific ground water monitoring data are obtained either by Department staff, permit-holders, or as a result of enforcement agreements. Ground water samples are generally tested in commercial laboratories according to EPA or DEP standard methods. The Bureau of Land and Water Quality requires ground water monitoring at project sites that are subject to its jurisdiction when an existing or proposed activity either poses a risk to ground water quality or quantity or an adverse impact has already occurred.

Activities that are considered a risk to ground water quality or quantity include: quarries, borrow pits, metallic mineral mines, fuel storage/handling areas (both wood wastes and petroleum), golf courses, infiltration basins and wastewater treatment lagoon/spray irrigation areas. Also of concern are subdivisions utilizing large-volume or community subsurface wastewater disposal systems, or nitrate-reduction (e.g. peat-matrix) systems. Areas with shallow-to-bedrock soils that are within sensitive lake watersheds are also generally required to monitor ground water.

Consistent monitoring requirements for sites engaged in the same type of activity have been developed, based on similarities in the site usage and wastewater quality generated. The facilities covered under this program are limited to those using land-application of wastewater as a means of disposal. The facility types include small wastewater generators, principally seasonal campgrounds, municipal sanitary wastewater facilities, and blueberry processors. Required parameters and monitoring frequencies are generally field parameters (water elevation, temperature, pH, and specific conductance, indicators of nitrogen loading and speciation for sites treating sanitary wastewater (nitrate and TKN), and indications of organic-matter loading (COD) and dissolved oxygen). Additional monitoring requirements might apply to any facility receiving wastewater with characteristics substantially different from those assumed in the standard monitoring requirements. Monitoring requirements for industrial and commercial facilities other than blueberry processors will continue to be considered on a case-by-case basis, depending on the pollutants, pollutant concentration, and volume of wastewater generated.

Development of a database including analyte data from these and other facilities is ongoing, and discussed further in the section on the EGAD ground water database.

Similarly, the DEP Bureau of Remediation and Waste Management (BRWM) requires periodic sampling and/or reports from hazardous waste storage facilities and generators. Additional sampling may also be required under the terms of enforcement agreements. BRWM field staff sample ground water to determine ground water quality impacts associated with uncontrolled hazardous waste sites, oil or fuel spills from stationary or mobile sources and from approved hazardous waste or hazardous material storage facilities. BRWM requires ground water monitoring at all licensed landfills where the monitoring of upgradient and downgradient wells for detection parameters is required, at a minimum. Detection parameters are considered reliable indicators of potential effects of the landfill on ground water. Facilities are required to monitor for an extensive list of compliance parameters whenever detection monitoring indicates a significant trend of change in ground water quality. Other BRWM ground water monitoring is intended to help locate new water supplies to replace those polluted by leaking underground storage tanks (LUSTs).

In early 1998, several incidents of MTBE contamination arising from gasoline spills focused the attention of the public and policy makers on the potential threat to ground water posed by MTBE. The Governor directed state health (DHS) and environmental (DEP, MGS) agencies to study the occurrence and concentrations of MTBE in the State's drinking water supplies. The study is summarized in the "Public Health and Environmental Concerns" section of this report.

Sand and gravel aquifers are geologic settings that are particularly susceptible to adverse ground water impacts and they are significant sources of drinking water. MGS sand and gravel aquifer maps are useful in defining aquifer boundaries. Since these boundaries are mapped in a GIS (geographic information system), they can be combined with the DHS water supply data and the contaminant site and land use data available in DEP databases. This type of spatial analysis allows current and future threats to the ground water contained in aquifers to be better understood and remediated or avoided altogether.

Aquifer Characterization Activities

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Related Websites:

(Aquifer Fact Sheet) www.maine.gov/doc/nrimc/pubedinf/factsht/hydro/hydfact.htm

(Aquifer Mapping) www.maine.gov/doc/nrimc/pubedinf/factsht/hydro/aquifmap.htm

As far as characterizing the physical and chemical attributes of the State's stratified drift aquifers, the Maine Geological Survey (MGS) is at the "average characteristics" stage. While site specific data do exist for some aquifers (primarily in the vicinity of ground water resource evaluation projects and contamination sites), complete physical pictures of most aquifer systems do not exist. Hard data on the exact natural chemical processes controlling ground water chemical evolution that occur along a flow path in sand and gravel aquifers are also lacking. MGS has some ambient water quality data but has not yet fully characterized any particular aquifer system.

MGS has developed a program to annually collect ambient bedrock ground water samples for background quality from different geographic and geologic settings in the state; Camden, Rockland, Rockport area (2000), northeastern Maine in the Presque Isle area (2001), and west central Maine in the Weld area (2002). This program was suspended in year 2003 due to budget constraints, but it will be continued in 2004 on the east side of Penobscot Bay. Ongoing studies of arsenic in Maine ground water wells are being conducted through cooperative efforts between MGS, the University of Maine, and the USGS. A program to collect basic data on bedrock aquifer characteristics from well drillers is ongoing. Finally, the stratified drift aquifer mapping program is continuing, with an effort to complete mapping of such aquifers at a 1:24,000 scale. This mapping program is focused in the same region as the bedrock ground water quality studies.

Overview of Ground Water Contamination Sources

Most ground water contamination in Maine originates from nonpoint source pollution rather than point source pollution. Table 6-1 lists the contaminant sources that are the greatest threats to ground water quality.

Table 6-1 Major Sources of Ground Water Contamination

Contaminant Source	Ten Highest Priority Sources (X)	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications	X	BCDE	EA
Irrigation practices			
Pesticide applications	X	AFGBE	ABD
Storage and Treatment Activities			
Land application			
Material stockpiles			
Storage tanks (above ground)	X	ACDE	DEC
Storage tanks (underground)	X	ADEC	DEC
Surface impoundments			
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	X	ACDE	EGHC
Septic systems	X	ABDC	EJCKL
Shallow injection wells	X	DC	CDH
Other			
Hazardous waste generators			
Hazardous waste sites	X	ABCDEF	CDHABM – non-halogenated solvents
Industrial facilities			
Material transfer operations			
Mining and mine drainage			
Pipelines and sewer lines			
Salt storage and road salting	X	ABCDFE	GH
Salt water intrusion			
Spills	X	ACDEFGH	ABCD
Transportation of materials			
Urban runoff			
Other sources			

Key 6-1 for the Factors and Contaminants Listed in Table 6-1 "Major Sources of Ground Water Contamination"

Factors Considered in Selecting a Contaminant Source	
A	Human health and/or environmental risk (toxicity)
B	Size of population at risk
C	Location of sources relative to drinking water sources
D	Number and/or size of contaminant sources
E	Hydrogeologic sensitivity
F	State findings, other findings
G	Documented from mandatory reporting
H	Geographic distribution/occurrence
I	Other criteria, specified

Contaminants Associated With the Source	
A	Inorganic pesticides
B	Organic pesticides
C	Halogenated solvents
D	Petroleum compounds
E	Nitrate
F	Fluoride
G	Salinity/brine
H	Metals
I	Radionuclides
J	Bacteria
K	Protozoa
L	Viruses
M	Other, specified

The following discussion focuses primarily on nonpoint contamination sources that appear to be responsible for most ground water contamination in the State: agriculture, hazardous substance sites, spill sites, landfills, leaking underground and above-ground storage tanks, road-salt storage and application, septic systems, shallow well injection, saltwater intrusion, and waste lagoons. In addition to these major sources, diverse land uses such as sludge, septage and residual land applications, metallic mines, borrow pits and quarries, golf courses, dry cleaners, automobile service stations, cemeteries, and burned buildings are also potential threats to ground water.

Petroleum Product Spills and Leaking Underground Storage Tanks

Underground Tanks

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Related Websites: (General Information) www.maine.gov/dep/rwm/ustast/index.htm

(Latest Rules for UST Facilities) www.maine.gov/sos/cec/rcn/apa/06/096/096c691.doc

Studies Lead to New Rules

The previous 305(b) report from 2002 discussed two studies undertaken to see how effective the Underground Storage Tank (UST) laws were in the field. These two studies along with a third, additional, study led to changes in the UST rules. The source of funding for these studies is the Maine Groundwater Oil Clean-up Fund, which derives its funds from a fee placed on all oil and gasoline imported into the state. These three studies are summarized below:

1) Study of Underground Storage System Annual Inspection Reports, July 2000

Maine UST regulations do require annual inspections of all UST facilities. However, these regulations do not require the results of the inspections to be sent in to the DEP, instead the inspection results are to be kept on-site at the facility. The objectives of the study were to determine how many facilities were actually inspected, what problems were found, and once identified, which problems were corrected.

As a result of the study, many facilities were found not to be conducting an annual inspection, and many of the problems found during annual inspections were not being corrected. Following the publication of the report, legislation was passed requiring the results of the annual inspections to be sent to the DEP. A detailed annual inspection form was designed that among other things, requires the inspector to view and test nearly every component of an underground storage facility. This resulted in the creation of an entirely new class of skilled technician. Before, DEP- licensed Certified Tank Installers were allowed to inspect tanks. Now, the newly created class of Certified Tank Inspector can also perform these annual inspections. To become a licensed Certified Tank Inspector one must pass a rigorous, written test administered by the Board of Underground Storage Tank Installers.

The annual inspection requirement affects almost 3,200 facilities. The first deadline under this new rule was July of 2003. As of January 2004:

- 77% of the facilities had passed the annual inspection,
- 12% failed the annual inspection and have yet to report back on the status of the corrections to the DEP, and
- 11% failed to have their USTs inspected (or have not yet delivered the report to the DEP)

The new rules allow streamlined procedures for prohibiting delivery to tanks that have not passed the annual inspection. The full report can be viewed at:

www.maine.gov/dep/rwm/ustast/ustinspectionreportintro.htm

2) Study of Cathodically Protected Underground Storage Systems, January 2001

Maine UST regulations require annual monitoring of cathodically protected storage system components. The objective of the study was to determine what percentage of cathodically protected tanks and components meet established criteria. As a result of the study, rules governing USTs now require three passing voltmeter readings spaced along the centerline of the cathodically protected tank up from one passing reading as was previously allowed. These new rules will become effective in the spring of 2004. The full report can be viewed at: www.maine.gov/dep/rwm/publications/cpreport.htm

3) Dispenser and Submersible Pump Study, October 2003

The main objective of this study was to quantify the frequency and estimate the severity of leakage from motor fuel dispensers and submersible pumps associated with USTs. During the course of the study 99 facilities, 253 dispensers, and 107 submersible pumps were visited and inspected. The inspections found:

- 46% of the dispensers without sumps had soil contamination in excess of DEP's standard, which is 100 ppm total petroleum hydrocarbons (100 ppm TPH).
- 63% of the submersible pumps without sumps had soil contamination in excess of DEP's standard, 100 ppm TPH.
- 10% of the sumps (dispenser pans under a dispenser or the submersible pump sump on the top of a UST) contained enough product to be considered "evidence of a possible leak" by the DEP. (UST owners must report each incident of "evidence of a possible leak" to the DEP.)
- 47% of the facilities visited had "evidence of a possible leak". Note that one facility can have many dispensers and submersible pumps.

The results of this study led to the following changes in Maine's UST rules:

- Dispenser sumps and sensors are required on all new dispensers.

Previously, facilities were allowed to assume that if there was a leak underneath the dispenser, product would fill the bottom of the dispenser, rise to the level of the secondary containment piping, exit the dispenser sump and flow downhill through the secondary containment piping, fill the sump on top of the UST, and trigger the alarm (sensor) located there. This method is not reliable because the connection between the dispenser sump and the secondary containment piping is often not leak-proof. Placing sensors in each sump underneath a dispenser will signal a leak much more quickly and reliably than the previous method.

- New dispenser sumps must have an opening large enough to catch all product dripping from the dispenser or flowing into the dispenser.

The study noted that the throat of the sump beneath many dispensers was very narrow when compared to the footprint of the dispenser. This allows leaking product from the dispenser to drip on the outside of the sump. Inevitably, this flow of product into the soil around the dispenser will cause contamination.

These new rules will become effective in the spring of 2004. The full report can be viewed at: www.maine.gov/dep/rwm/ustast/pdf/sumpstudyreport.pdf

Maine's New Underground Storage Tank Siting Law

Effective September 30, 2001, it is prohibited to install new motor fuel, waste oil, and marketing and distribution underground storage tank (UST) facilities within 300 feet of a private drinking water supply well, within 1000 feet of a public drinking water supply well, or on the “source water protection area” of a public water supply (as mapped by the DHS Bureau of Health). A process to allow for variances is included in the regulations.

Effective August 1, 2002 the installation of new motor fuel, waste oil, and marketing and distribution UST facilities over significant sand and gravel aquifers is restricted, although not prohibited. The reason for this restriction is that many of these significant sand and gravel aquifers are likely future sources of water supplies for cities and towns.

During this initial period of enactment (with the first part of this siting law in effect for over two years and the second part in effect for over one year) the law appears to be working as designed. To date, the DEP knows of only four UST installations affected by this regulation. This number seems small, but it is possible that knowledgeable builders and developers are aware of the siting restrictions and are avoiding the placement of facilities in areas restricted by this regulation.

The four known cases that were affected by this regulation are described in the following paragraphs.

Case 1 - A storeowner with a small lot at a crowded intersection wished to install a new UST facility. A marketing and distribution UST was not allowed at this site. Also, there was not enough room on the lot for an aboveground storage tank (AST) to satisfy the setback requirements of fire codes. To date no AST has been installed.

Case 2 - A chain of convenience stores bought a lot next door to one of its stores with the plan to add a diesel dispenser island. Both the existing lot and the new lot were within 1000’ of a community water supply. Although the new UST would be on the original site, and therefore allowed under the new regulations, the piping and the diesel dispenser would extend onto the new lot. This was not allowed. The site owner changed the layout to keep all piping and the new dispenser on the original site. Even though traffic routes and parking lots extended onto the newly acquired lot this arrangement complied with the new regulations.

Case 3 - Another site had USTs at one time, but they were removed several years ago. Under the siting regulation, once tanks come out, they cannot go back in if the site (as in this case) is within the regulated distance from private and public water supplies. Because of this new UST siting law, no USTs were allowed. The small size of the site, the location of the store on the site, the required fire protection setbacks, and the presence of a wetland meant a traditional AST installation was also prohibited. The solution was to build a large above ground concrete vault with a sheet metal roof to house a 15,000-gallon tank.

Case 4 - Private wells were close to a prime convenience store site, and the site owners did not wish to deal with the loss of parking space and other aspects of an aboveground storage tank. The result was the installation of a tank manufactured by ArmorVault™. These steel tanks inside a concrete vault are similar to those made by ConVault™, but the entire vault is buried. Unlike traditional “vaulted” tanks where a large underground structure houses the tank and leaves ample room to walk around the tank, these “below-grade, aboveground storage tanks” have small clearances of approximately 2” between the tank and the inside of the vault wall on three sides, with a large clearance of 2’ to 3’ on one end of the tank. The facility has been in operation for less than one year.

Leaking Underground Tanks and Drinking Water Wells

In December of 1994, the DEP created the Leaking Underground Storage Tank (LUST) Remediation Priority List to keep better track of clean-up sites and to provide an objective scoring system to determine which sites received scarce clean-up dollars. In general, the higher the score, the more quickly resources are allocated to clean up a site. Since its inception, a total of 1,233 sites have been placed on the priority list in the "active" category (requiring clean-up), 842 sites have been "closed" (site has been cleaned-up to a given standard and therefore taken off the list). As of March 2004, there were 365 active sites on the list. The sites on the priority list are limited to those contaminated by petroleum products. Table 6-2 shows the number of private water wells and public water supplies contaminated by petroleum products or threatened with contamination by petroleum products as of March 2004. Note that one active site can contaminate or threaten more than one well.

Table 6-2 Current (March 2004) LUST Remediation Priority Sites – Contamination Summary

Number of Contaminated Wells*	Number of Contaminated Public Water Supplies	Number of Threatened Wells*	Number of Threatened Public Water Supplies
348	23	268	35

* Does not include public water supplies.

Although many sites are closed and removed from the active priority list each year, new sites are also discovered and placed on the active priority list. For example, during the years 2002 and 2003, 291 known sites were closed, but 292 new sites were added. To reduce this backlog of active sites on the priority list, the DEP created two permanent staff positions, both of which are in the Bangor field office. These two positions, a Certified Geologist and a Project Manager, were filled in December 2001 and February 2002, respectively.

Tanks in the Ground in Maine

In 1985, legislation passed that required the registration of USTs and their removal according to a phased-in schedule. Removal was prioritized to first eliminate tanks posing the greatest threat to ground water. As of March 2004, contractors had either removed or cleaned and "abandoned in place" over 37,000 tanks. Of this total, more than 32,000 were tanks constructed of bare steel (where tank walls have no protective coating and no cathodic protection). These tanks are very likely to leak and cause ground water contamination. Over 29,000 of these bare-steel tanks were removed before the October 1997 deadline, one year before the Federal deadline of October 1998. Since then, Maine's active, registered, bare-steel tank population has been reduced to a minute but stubborn population of 266 tanks. Most bare-steel tanks are discovered, registered (added to our database), and removed within a few months. This is especially true when a bare steel tank is discovered during the sale of real estate. However, some tanks are discovered, then registered, but not removed for many months. Most of these remaining bare-steel tanks are residential, "consumptive use" heating oil USTs, meaning that they are used by homeowners.

The DEPs TANKS database currently (as of March 2004) shows 5,343 active, registered USTs. The total storage capacity (volume) of these active USTs amounts to 39.3 million gallons with over half of the volume registered to store gasoline. Details of the UST products and volume figures are provided in Table 6-3 below.

Table 6-3 Information on Active, Registered USTs as of March, 2004

Product Stored	Volume (millions of gallons)	Percentage
Gasoline (no Aviation Fuel)	21.04	54%
Heating Oil (#1 and #2)	9.75	25%
Diesel	6.31	16%
Other (includes petroleum and non-petroleum products)	2.15	5%
Total	**39.25**	**100%**

New Underground Storage Tank Database

The DEP’s underground storage tank database has undergone a $462,000 dollar upgrade to make it easier for the six-person tanks enforcement staff do its job and to have more data available online for the entire Response Division. This, in turn, should provide response staff with information needed to more efficiently coordinate the clean-up of petroleum and hazardous material spills. Also, the database can now store “histories.” Previously, most of the information was limited to only a current snapshot of the data. Now the results of inspections and the history of enforcement actions and correspondence can be viewed. This allows better tracking of inspections, “evidence of possible leaks”, and all corrective actions for enforcement cases. In addition to these improvements, data from the DEP Bureau of Air Quality (BAQ) can now be entered directly into the database.

Spill-Proof Gasoline Cans

Through the years, DEPs Response Division has visited many homes and small businesses in order to investigate and clean up spills. During these visits, staff has seen first hand just how plentiful petroleum-powered tools and toys are in this state. They also see how these machines are used, stored, and filled with fuel. When one considers these activities in light of how often gasoline constituents are discovered in drinking water wells that are far from any gas station or convenience store, connecting a common cause and effect was not difficult. So the DEP decided that there was more that could be done in the home to prevent ground water contamination around the home. The main result of this effort was to develop regulations to require the sale of spill-proof gasoline cans in Maine. In addition to the regulations, staff members from BRWM and BAQ have written informative articles about spill proof gas cans for distribution to newspapers and have exhibited the cans at various fairs and public events. These outreach efforts appear to have been effective and current plans are to continue with them into future.

Above Ground Storage Tanks

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Above Ground Storage Tank Spill Information

Since 1995, when the Maine DEP started keeping track of spills from above ground storage tanks (ASTs) there has been an **average of one heating oil spill per day from ASTs at single family residences!** One reason for this statistic is the prevalence of ASTs in Maine. The 1990 U.S. Census figures show that 70% of Maine households are heated with oil. The vast majority of these households have 275 gallon ASTs located either in the basement or outside the residence. In the nine years of record keeping, 2001 had the highest number of spills from heating oil tanks at single family residences with 592 spills. There were 443 spills in 2002 and 439 spills 2003, placing both years slightly above the average of 406 spills per year. Except for 1998, the single most common cause of spills from single family residential ASTs from 1995 through 2003 was corrosion. Single family residential AST-related spills were also caused by tank overfills, ruptures, tip-overs, and other mishaps.

Installing a filter protector over the oil filter is the simplest way to prevent snow and ice from breaking the filter off of an outside tank. To encourage homeowners to take this step, DEP contracted with an advertising agency to produce a public service announcement (PSA) that was aired frequently in early 2002. Although it is difficult to determine how many filter protectors have actually been installed because of this advertising campaign, the DEP did receive many phone calls requesting information on filter protectors. The DEP soon made another version of this ad for summertime use, and February 2004 saw a rebroadcast of the original PSA via both paid advertisements and public service announcements. For this rebroadcast, pre- and post-statewide surveys were conducted to measure the effectiveness of the advertising campaign. The results of this survey are not yet available.

The frequency of spills makes home heating oil tanks significant contributors to ground water contamination. Aside from single family residential ASTs, other ASTs also contribute to ground water contamination, but the number of spills involved are much smaller. In 2002 and 2003 only 181 and 212 heating oil spills, respectively, occurred from ASTs serving structures other than single family residences. In 2002, an additional 85 spills came from ASTs storing other petroleum products, such as gasoline; and only 60 spills from these types of tanks occurred in 2003. Overfilling was the single largest cause of these spills, with mechanical failure and corrosion also being significant causes of spills.

In contrast to the many household AST's, there are fewer AST's requiring permits from the Department of Public Safety (combustible fuel, tanks over 660 gallons, or installations with over 1,320 gallons aggregate). From June 1996 through December of 1999, permits for 495 ASTs were issued. This is an average of 138 tanks permitted per year. From 2000 through 2003, only 97, 104, 121, and 134 ASTs were permitted each year, respectively. The annual average number of new AST permits from 2000 through 2003 declined to 114. It should be noted that these numbers do not include tanks storing liquefied petroleum since this product does not pose a threat to ground water.

The DEP's Home Heating Oil Tank Replacement Program started in 1998. This program uses money from the State's ground water insurance fund to replace old, unstable, and/or leaky tanks and supply lines at low-income households. Through this program new, properly installed, UL80 (bottom outlet to prevent corrosion) tanks are installed free of charge. This highly successful program is conducted by local social service agencies that work with low-income households. Costs average about $1,100 per new tank installation.

Spill Prevention, Control & Countermeasures Program for Above Ground Tanks

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Related Website: www.maine.gov/dep/rwm/spcc/

In the spring of 2002, the Maine Legislature adopted legislation granting the DEP jurisdiction to enforce the federal Spill Prevention Control and Countermeasures (SPCC) regulations (40 CFR Part 112) for facilities that “market and distribute oil to others.” Retail gas stations and bulk plants comprise the majority of facilities that are subject to the state SPCC statute. Airports and marinas comprise a smaller portion of facilities subject to the statute. The State SPCC statute also mandated that the DEP provide education and outreach to affected facility owners to encourage their compliance with the federal SPCC rules. Starting in the summer of 2002, the DEP retained a private environmental consulting company to develop model SPCC plans and a series of public training seminars. The model SPCC plans for retail facilities and bulk plants and a SPCC Guidance Document were drafted in the fall of 2002, and were last revised in January, 2004.

The DEP hired an environmental specialist to staff the SPCC program in March of 2003. Then in June of 2003, the DEP developed and posted a web page devoted to SPCC planning for AST facilities (see the link above). During the summer of 2003, the DEP compiled a preliminary list of all AST facilities in the state, based upon several existing state databases. Approximately 470 facilities are subject to the State SPCC program. During the summer and fall of 2003, DEP staff began SPCC technical assistance site visits to these AST facilities. In the fall of 2003, the DEP held a series of four SPCC training seminars across the state. A total of approximately 170 people attended these seminars, including facility owners and operators, consultants, and governmental staff.

Current projects within the SPCC program include developing a list of consulting Professional Engineers available to facility owners for SPCC planning, periodic letters to AST facility owners regarding topics pertinent to AST facilities, and developing guidelines on managing stormwater accumulation in dikes. The SPCC program will continue conducting SPCC technical assistance site visits during the 2004 field season.

Bulk Plant Trends: Submerging of Bulk Plants just a Blip?

In the 2000 305(b) Report that covered the years 1998 and 1999, it appeared that large (30,000 gallons or greater) underground storage tanks (USTs) at bulk fuel plants were a new trend that might replace the traditional above ground bulk plant. However, subsequent data shows little evidence to support that view.

1996 was the banner year for large USTs at bulk plants. Eight large (30,000 gallons or greater) tanks were installed at three different facilities, with four 50,000 gallon USTs being installed at one location. Since 1996, only four large (30,000 gallons each) USTs have been installed at bulk fuel plants, and none of these occurred after the year 2000. In contrast, the number of large petroleum ASTs permitted in the years 1997 through 2003 increased each year from zero in 1997, to 3 in 1998, 1 in 1999, 4 in both 2000 and 2001, 1 in 2002 and 17 in 2003. Table 6-4 compares these recent trends between UST and AST bulk plants.

Table 6-4 New Large UST Bulk Plants vs. New Large AST Bulk Plants

Year	Large* Underground Storage Tanks at Bulk Fuel Plants	Large* Above Ground Storage Tanks at Bulk Fuel Plants
1996	8	0**
1997	0	0
1998	1	3
1999	0	1
2000	3	4
2001	0	4
2002	0	1
2003	0	17

* large means a tank capable of holding 30,000 gallons or more
** data available from 6/5/96 – 12/31/96 only

Spills

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Related Websites: (Database Reports) www.maine.gov/dep/rwm/data/index.htm

(2002 Spill Report) www.maine.gov/dep/rwm/publications/pdf/2002statisticalreport.pdf

The Department's BRWM responded to approximately 5,508 reports of oil or hazardous material spills between January of 2002 and December of 2003. Of these 5,508 spills, 372 do not have completed reports and, therefore, are not included in this discussion. Over 74% of these responses involved discharges of petroleum products to soil and/or ground water. Between 2002 and 2003, response services personnel discovered over 114 wells that had been contaminated from these spills. Table 6-5 provides information on the 5,136 spills that had completed spill reports.

Table 6-5 Oil and Hazardous Materials Spills – January 2002 to December 2003

Spill Location Type	Percent of Total Spills	Number of Spills	Number of Wells Impacted
Business	23.27%	1,195	19
Government	7.18%	369	1
Residential	29.07%	1,493	78
School	2.06%	106	3
Terminal	11.84%	608	12
Transportation System	13.82%	710	1
Utility	8.26%	424	0
Other	4.50%	231	0
Total	**100%**	**5,136**	**114**

Agriculture

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In 1992, the total estimated cropland and pastureland in Maine was greater than 566,000 acres. The agricultural community uses chemicals for pest control and weed eradication; in addition, many farmers apply chemical fertilizers and manure to their agricultural lands. These are all major, potential sources of ground water contamination. Farmers apply over 58,000 tons of chemical fertilizers and 2.1 million tons of manure to agricultural land in Maine each year. In 1992, the Department of Agriculture estimated that chemical fertilizers were spread on over 250,000 acres. The major areas of chemical application include potato fields in Aroostook County, blueberry barrens in Hancock and Washington Counties, and apple orchards and forage cropland in Central Maine. Pesticides and nitrates are the main category of agricultural ground water contaminants.

Maine's Nutrient Management Law

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In 1998, the Maine Legislature enacted legislation entitled: “An Act Regarding Nutrient Management.” This law will have a significant impact on how Maine’s farmers handle farm wastes and how they utilize nutrients on the farm.

Requirements of the Law: There are two central components of the Nutrient Management Law:

- A manure spreading ban between December 1st and March 15th and,

- A requirement of all farms that confine and feed 50 animal units (au – where 1 au = 1,000 lbs of live animal body weight) or more at any one time to develop and implement a Nutrient Management Plan (NMP).

The law also states that NMPs must be prepared by a certified nutrient management planner. An NMP provides details on how farm nutrients will be stored, managed and utilized. The NMP also includes plans for intended manure uses as well as actual data that are recorded to document actions taken with regard to the planned usage.

Each of these requirements takes effect on a different date. The winter spreading ban went into effect on December 1, 1999. Nutrient management plans for most farms had to be completed and approved by January 1, 2001 but they need not be fully implemented until October 1, 2007. The time between development of a plan and full implementation allows farmers to arrange financing, buy equipment, and build or upgrade manure storage and handling systems necessary to implement the plan. It is expected that those parts of the plans that do not require structural changes or major investments will be implemented as soon as the plan is approved.

The Law also requires that certain other farm operations develop and implement a nutrient management plan. These include farms that:

- Utilize over 100 tons of manure per year that are not generated on the farm,
- Utilize or store regulated residuals, such as sludge,
- Have a DOA-verified complaint of improper manure handling. In this case an NMP must be developed and implemented according to a schedule established by the Department Commissioner.

Another significant component of the Maine Nutrient Management Program is the training and official recognition of Certified Nutrient Management Planners (CNMP). The University of Maine Cooperative Extension and the Natural Resource Conservation Service are conducting this part of the program. The program offers two types of training. One track is for people who want to be certified as commercial or public CNMPs while the other is for farmers who want to be certified as private CNMPs for their own farming operations. The commercial/public specialist may write and certify plans for anyone, while private certification only allows a farmer to prepare and approve his or her own plan. Failure to meet the standards established for an acceptable Nutrient Management Plan can result in the loss of certification.

In addition to the provisions outlined above, the law also:

- Provides for the establishment of a Nutrient Management Review Board whose duties include approving rule changes, hearing appeals on permit or certification decisions made by the Commissioner, and making recommendations to the Commissioner on issues pertaining to nutrient management.
- Requires that livestock operations obtain a Livestock Operations Permit from the Department of Agriculture if:
- The operation is new, with greater than 300 au or is expanding to greater than 300 au.
- The operation meets the EPA definition of a Concentrated Animal Feeding Operation (CAFO).
- The operation plans to expand beyond its land base or manure storage capacity.

Key requirements for obtaining a permit are having an approved NMP and a facility inspection by the Department of Agriculture.

Impacts of the Law: The implementation of this law has had a number of impacts. These include increased building of manure storage facilities, a significant reduction in winter spreading, and more efficient use of manure and other nutrients for crop production. As farmers take training to become CNMPs or work with a commercial / public CNMP to develop an NMP, they will become more aware of the value of the manure they generate and how it is best utilized. By basing manure application rates on soil tests and crop needs, and not proximity to the barn or feedlot, fields will receive appropriate amounts of manure. Those fields needing additional nutrients to meet crop needs will also much more likely to be identified.

Implementing nutrient management on farms will better protect ground and surface water. By applying manure and other nutrients only in the amounts needed for crop production and in a way that will consider nearby sensitive resources, fewer nutrients will leave the site and impact water quality. Studies of Maine farms where nutrient management practices have been implemented show that water quality within a watershed can be significantly improved.

The implementation of nutrient management plans, which must contain Best Management Practices (BMPs) for insect and odor control, should result in fewer nuisances, in fewer conflicts with neighbors, and consequently in fewer associated complaints to the Department of Agriculture. As the program evolves and all the components are put in place, more BMPs will be implemented on Maine's farms, thereby providing an additional benefit of improved water quality.

Pesticides

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Related Website: www.maine.gov/agriculture/pesticides/water/index.htm

Before the mid-1970s, it was thought that soil acted as a protective filter that stopped pesticides from reaching ground water. Subsequent national and state studies have shown that this is not always the case. Pesticides can infiltrate soils and reach aquifers from applications onto commercial lands (cropland, forestry, rights of way, etc.) and home lawns, accidental spills and leaks, or improper disposal. In Maine, increased concern about pesticides in ground water began in 1980 when the agricultural pesticide, aldicarb (trade name Temik) was found in private drinking water wells located near potato fields. Since then, a variety of monitoring projects have been conducted in Maine to determine if the use of pesticides has impacted the quality of ground water.

A summary of pesticide studies follows:

1985: The Maine Geological Survey (MGS) and the Maine Department of Agriculture, Food and Rural Resources (DAFRR) began a three-year evaluation of the effects of agricultural pesticides on ground water. Study results showed that mostly trace levels of pesticides were found in 14% of the samples and suggested that bedrock wells overlain by till in potato regions had the highest incidence of contamination by agricultural pesticides.

1989: MGS, DAFRR, and USEPA tested private wells near potato fields in Aroostook County. Water from 42% of the 51 samples showed traces of pesticides.

1990: The Board of Pesticides Control (BPC) and the University of Maine conducted a study to evaluate the effectiveness of immunoassay testing for monitoring pesticides in ground water samples. Of the 58 wells sampled near pesticide use sites:

- 31% had detectable concentrations of atrazine; two wells had concentrations higher than the MCL of 3.0 ppb,
- 12% had detectable concentrations of alachlor and exceeded the maximum contaminant goal level (MCGL) of 0 ppm,
- 5% had detectable concentrations of carbofuran below the MCL of 40 ppb.

1992: The BPC and the University of Maine conducted the Maine Triazine Survey to verify the reliability and accuracy of immunoassay tests and to aid in the development of Maine's Ground Water Management Plan. Of the 152 samples subjected to immunoassay tests:

- 21% tested positive for the triazine immunoassay (which reacts to both atrazine and simazine),
- Laboratory confirmation found that 20% of all sampled wells were positive for atrazine,
- 3% of all sampled wells were positive for simazine, and 1 sample (<1%) was positive for cyanazine.

1994: The BPC began a statewide ground water monitoring program to assess the impact of highly leachable pesticides on Maine ground water across a variety of agricultural and non-agricultural use sites (e.g. corn, potato, blueberry, Christmas tree, rights-of-way, oat, market garden, and orchard sites). One hundred twenty-nine private domestic wells with certain characteristics were targeted for sampling. The specific well characteristics were that they had to be within ¼ mile of an active pesticide use site and that they had to be either hydrologically down gradient of, or at an even hydrological gradient with, the use site.

Monitoring results were as follows:

- 21% tested positive for at least one of ten pesticides detected during the survey,
- Hexazinone was detected in 15 of the 20 samples tested for the herbicide; the highest detection was 5.97 ppb, well below the health advisory level of 200 ppb,
- Diazinon was detected in one well at a level exceeding the MCL; the well owner stated she used the insecticide around her well casing for ant control,
- Dinoseb was detected in one well but had no registered uses in the state; an investigation of the site found an old, rusty container of the herbicide stored next to the well.

1996: Wells sampled during the 1992 Triazine Survey were re-sampled to determine if new ground water protection measures on the labels of atrazine- and cyanazine-containing pesticides along with the promotion of best management practices (BMPs) for the use of atrazine, simazine, cyanazine, alachlor and metolachlor on corn were effective. In 1992, 38 wells had detectable levels of pesticides; in 1996, only 12 of those 38 wells still had detectable concentrations.

Also in 1996, the BPC published the *State of Maine Hexazinone State Management Plan for the Protection of Ground Water*. New regulations regarding the purchase and application of hexazinone were created under CMR 01-026 Chapter 41: Special Restrictions of Pesticide Use (effective date August 17, 1996).

1998: *Section VII: Monitoring* of the Hexazinone State Management Plan requires the BPC to conduct an assessment of private domestic wells in hexazinone use areas once every four years. The 1994 statewide ground water monitoring project was the first assessment, and 1998 brought the second round of monitoring. The rate of hexazinone detections fell from 75% in 1994 to 42.8% in 1998.

The first revision of the State of Maine Generic State Management Plan for Pesticides and Ground Water was adopted in 1998. The most significant change to the original Plan was in *Section VIII: Response Framework*. The original Plan only required a response (i.e., site inspection, additional monitoring sites) when a certain concentration of a contaminant was reached. The high percentage of wells tested in 1994 with relatively low hexazinone detections resulted in a change in the response framework. The revised plan requires a responsive action not only when a certain concentration of a pesticide is reached, but also when a certain percentage of wells have detections.

1999: *Section VII: Ground Water Monitoring* of the Generic State Management Plan for Pesticides and Ground Water states that the BPC shall assess the occurrence of pesticides in private domestic wells which were within ¼ mile down gradient to active pesticide use sites. The second such assessment was conducted in 1999. A summary of the results is as follows:

- The percentage of tested wells with pesticide detections dropped from 23.3% in 1994 to 9.0% in 1999,
- The number of pesticides detected went from 10 in 1994 to 4 in 1999,
- No pesticides were detected at levels near their respective health advisory levels.

2002: Ground water monitoring as described in Maine's Hexazinone State Management Plan continued; 49 domestic wells within ¼ mile of blueberry fields were tested. The percentage of these wells with positive detections for hexazinone was 59.2%. This compares to 75% in 1994 and 42.8% in 1998. See Table 6-6 below for details on the monitoring activities.

Table 6-6 Hexazinone Monitoring Results - 1994 through 2002

Hexazinone Detection Rate, Mean and Median Concentration, And Highest Reading per Sampling Period			
	Spring 1994	**Spring 1998**	**Spring 2002**
Total Number of Samples Collected	20	42	49
Number of Positive Detections	15	18	29
Percentage with Positive Detections	75%	42.8%	59.2%
Mean Concentration*(ppb)	1.08	0.41	1.45
Median Concentration (ppb)	0.31	ND	0.43
Highest Reading (ppb)	5.97	2.15	11.41

*For statistical purposes only, mean concentration was calculated assuming that non detections (ND) were equal to half of the limit of quantification (LOQ). LOQ = 0.1 ppb for 2002 samples.

Studies have shown that there are pesticides in Maine's ground water. With the exception of a few sites that had point sources of contamination, the levels of pesticides detected do not present a health threat to the citizens of Maine when compared to the health-based standards established by the USEPA and the Maine Bureau of Health. However, at least in the case of pesticides, increased development along with the use of BMPs, lower application rates, and increased awareness of ground water issues should continue to have positive impacts on the quality of Maine's ground water.

Maine's Generic State Management Plan for Pesticides and Ground Water requires that a statewide sampling of ground water will occur every 5 to 7 years. So, plans for

2005 include a statewide ground water monitoring study similar to the 1999 study that was described above. This study will be undertaken and completed in accordance to and in order to comply with the State Plan.

Agricultural Nitrates

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The documented adverse health effects of nitrate (potential methemoglobinemia in infants and complicity in producing carcinogenic nitrosamines), and its mobility in ground water, may make it the most significant agricultural contaminant in Maine ground water. Nitrate in agricultural areas results primarily from application of chemical fertilizers and manure to cropland. While most of the chemical fertilizer is used on potato cropland, manure is spread primarily on corn and hay fields. In 1992, 755,000 tons of usable manure was produced on Maine farms. A breakdown of the percentage of manure produced by different domestic animals follows in Table 6-7:

Table 6-7 Domestic Animal Manure Production

Category of Domestic Animal	Percent of Manure Produced
Dairy Cattle	41 %
Poultry	32 %
Beef Cattle	17 %
Horses, Hogs & Pigs, and Sheep & Lambs	10 %

In the 1985 MGS/DAFRR three-year study cited previously under the pesticides section, 21 of 100 wells tested for nitrate had nitrate concentrations exceeding the 10 mg/L drinking water standard. The percentage of wells in each crop type exceeding the drinking water standard was greatest in market garden/forage crop regions (40%) and potato regions (23%). Wells in orchard and blueberry areas did not exceed the standard. Mean nitrate concentrations were highest in market garden/forage crop regions (8.6 mg/L) followed by potato regions (6.7 mg/L), orchards (1.1 mg/L), and blueberry areas (0.1 mg/L). Results of the 1989 MGS, DAFRR, and USEPA study conducted in the potato growing regions of Aroostook County showed a similar trend. Nineteen percent of the 211 wells (40 wells) exceeded the 10 mg/L primary drinking water standard for nitrate-N. It is important to note that the nitrate contribution from non-agricultural sources, such as septic systems, has not been evaluated at any of the sites.

The impact of typical manure storage and spreading practices on ground water quality merits greater investigation. Documentation of nitrate ground water contamination from manure storage and spreading currently is limited to DEP and DAFRR case files; these probably represent "worst case scenarios". Some "worst case" examples include a poultry farm in Turner where manure disposal caused extensive ground water contamination (nitrate-N above 600 mg/L locally) in both the overburden and bedrock aquifers and in surface waters; and domestic wells in Clinton and Charleston where leachate from nearby uncovered manure piles is alleged to have contaminated domestic wells with nitrate-N concentrations exceeding 100 mg/L.

In 1990, the Maine Legislature gave DAFRR primary responsibility for investigating complaints related to manure storage and spreading. In 2002, DAFRR investigated 100 complaints. Of these, 6 complaints related to concerns about ground water contamination. Ten complaints related to manure impacts to surface water bodies were investigated during this same period. While the total number of complaints has increased since the late 1990's, the number of complaints specifically concerning ground water or surface water contamination has actually decreased slightly.

The extent of nitrate ground water contamination from manure is unknown but may be significant. The Maine Soil and Water Conservation Districts 1988 Manure Management Project found that the plow layer in approximately one-half of the 249 corn fields sampled had more than twice the level of soil nitrate needed to produce a normal 25 ton/acre crop yield. Although not all of the excess nitrate will leach into ground water (some will be bound by soil organic matter), the data show that a very high potential for ground water quality degradation exists beneath these fields. The Maine Cooperative Extension Service originally published manure utilization guidelines in July 1972 (Miscellaneous Report 142). Revised non-regulatory guidelines were developed in 1990. The key elements include testing soil and plant nitrate levels prior to fertilizer application, and fertilizing according to realistic crop uptake rates. In March 2001, the Department of Agriculture adopted the document 'Manure Utilization Guidelines", replacing the outdated 1972 guidelines. These guidelines apply to any farm operation not required to have a nutrient management plan under the Nutrient Management Law.

DAFRR statistics for 1998 indicate that farmland available for manure spreading includes approximately 63,000 acres of hay, 25,000 acres of oats, 32,000 acres of silage corn, and 12,000 acres of vegetables and nursery crops. According to the agronomic spreading rates recommended in the 1980 Manure Management Project report, available hay and corn cropland can accept all of the manure generated annually in this state. However, because manure production is concentrated regionally, sufficient land for spreading may not be available in the areas of greatest manure production. Even when spreading areas are available locally, it is often economically unfeasible for a farmer to haul manure more than two miles from where it is stored.

Landfills

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Related Website: www.maine.gov/dep/rwm/solidwaste/index.htm

The Maine Department of Environmental Protection is directed by statute to regulate the location, establishment, construction, expansion and operation of all solid waste facilities in the state, including landfills. The Department is specifically authorized by the Legislature to "adopt, amend, and enforce rules as it deems necessary to govern waste management, including the location, establishment, construction and alteration of waste facilities as the facility affects the public health and welfare or the natural resources of the State". Further, "The rules shall be designed to minimize pollution of the State's air, land and surface and ground water resources, prevent the spread of disease or other health hazards, prevent contamination of drinking water supplies and protect public health and safety."

In 2001, Maine residents, businesses and visitors generated 1,884,059 tons of municipal solid waste (MSW), an 8.7% increase over the 1,696,006 tons reported in 1999. Of this amount, 432,822 tons were landfilled. In addition 20,651 tons of MSW generated outside of Maine were landfilled in Maine in 2001. Approximately 37.3% of the MSW stream was recycled and a significant percentage was incinerated. 155,195 tons of Maine generated incinerator ash was landfilled, as well as volumes of other types of "special waste," including sludges, paper mill wastes, and contaminated soils.

Of particular significance as related to ground water protection, the Department and the Maine Legislature have focused significant effort over the past two years toward developing legislation and programs that will ensure that certain hazardous constituents are removed from the waste stream prior to landfilling or incineration:

- The Department has worked in conjunction with the Maine State Planning Office to provide technical support and financial assistance to municipalities and regions in the establishment and maintenance of household hazardous and universal waste collection and management programs. The Department has provided extensive training opportunities to municipalities and schools. The State Planning Office has offered grants resulting in the development of collection infrastructure across the state.
- The Department developed a report that was submitted to the Legislature recommending a plan for the collection and recycling of cathode ray tubes (CRTs). The Legislature passed a law this session requiring manufacturers to take responsibility for recycling. A statutory ban on the disposal (landfilling and incineration) of CRTs will take effect on January 1, 2006.
- A statutory ban on the disposal of mercury-added products and switches will take effect on January 1, 2005. The Department also developed a plan to increase the collection and recycling rate of mercury thermostats. The Legislature passed a law concerning this subject during the last session. Mercury switches that are components of motor vehicles are required by law to be removed from the vehicles before they are sent to a scrap recycling facility.

Active Landfills

Related Website: www.maine.gov/dep/rwm/data/landfillactive.htm

There are currently 50 active, licensed landfills in the state of Maine (Figure 6-1). Of these, seven are licensed exclusively for MSW disposal. Seventeen (17) are licensed to accept "special waste" (several of these are also licensed for MSW and demolition debris disposal). Twenty-six (26) are licensed for the acceptance of wood waste and construction/demolition debris.

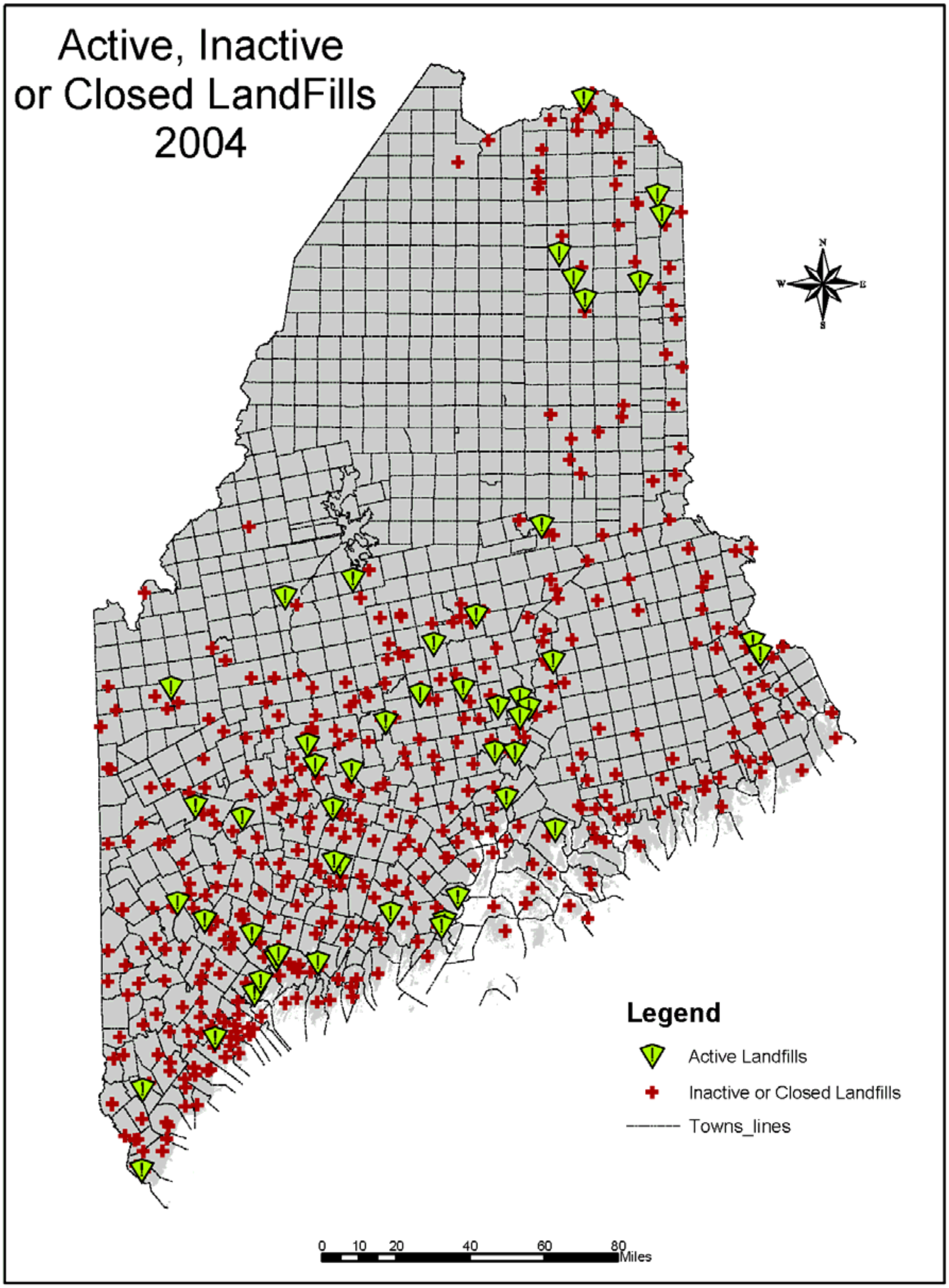

Figure 6-1 Active, Inactive or Closed Landfills in Maine

Inactive Landfills

A total of 414 municipal landfills have been identified in the state. As of July 2003, 388 of these landfills have been closed and capped (Figure 6-1). Twenty-six remain to be closed. These include 15 currently active sites and 11 inactive sites, which are no longer receiving solid waste. In all:

- 184 landfill sites are on sand and gravel aquifers and ground water contamination has been documented at 46 of these sites,
- Sixty other sites have contaminated surface water and/or ground water and are considered to be substandard; 37 of these 60 sites have serious ground water contamination,
- Hazardous substances in ground water are confirmed or suspected at 41 municipal landfills. Public or private water supplies are potentially threatened at 8 of these sites. Additional investigations have determined that 3 public water supplies previously considered at risk have been determined to be safe,
- 135 sites have no reported or documented problems with surface water or ground water,
- 13 of these inactive sites appear to be accepting demolition debris, and
- There are at least 65 sites where open burning occurred.

Maine's landfill closure and remediation program was established in 1987, with the goals of closing and remediating solid waste landfills that were inadequately designed and constructed, or inappropriately sited. DEP has conducted evaluations of municipal landfills and developed closure procedures. As a result of legislation in 1994, municipalities were allowed to determine for themselves (with proper documentation) whether or not their landfill meet the eligibility requirements for a "reduced procedure" closure. The reduced procedure is a further evolution of the Interim Cover and Grading (ICAG) procedure implemented by the Department in 1993. Towns that determined they were eligible for the reduced procedure were able to proceed immediately with the implementation of their closure without obtaining an advance permit from the DEP. These changes were important in enabling many smaller Maine municipalities to reduce costs and expedite the closures of their landfills.

A total of 327 municipalities have received state cost-share funding for past landfill closures or planning activities. As of January 1, 2000, municipalities are no longer eligible to receive state funding for closure activities. Maine voters have approved ten bond issues to fund assessment, closure, and remediation of landfills. A total of $79.25 million was made available during the operating history of the closure program. No additional closure-related costs will be incurred by the state.

The state is continuing with a cost share program on remedial actions that occur at closed municipal landfills where a threat exists to human health or the environment. Bond funds are being utilized for remedial development of replacement water supplies for residents in five of the eight towns where private water supplies are threatened. Maine is experiencing increased residential development in locations outside central city and town areas, especially in southern and coastal Maine. Continued uncontrolled development has the potential of placing future residential areas at risk if private supply wells are placed in areas already impacted by closed municipal landfill sites. The DEP is currently working with a number of towns to identify property that is at risk and to assist with the purchase of this property or to limit ground water use through some other mechanism.

Residual Land Applications

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Related Website: www.maine.gov/dep/rwm/residuals/index.htm

Land application and composting of solid wastes, such as food waste, wood ash, sewage sludge, paper mill sludge, or fish waste is regulated by the DEP in Department Rules, Chapter 419, Agronomic Utilization of Residuals. These rules establish a framework for the characterization of residuals to determine potential agronomic benefit and harm if the residual is applied to the State's agricultural or forest lands. The rules also establish siting criteria and management practices to protect public health and the environment at utilization sites. Other composting standards are contained in Department rules, Chapter 409, Processing Facilities. Septage land application and storage is regulated by Department Rules Chapter 420, Septage Management Rules.

Currently, residuals are processed and utilized at approximately 536 licensed land application and composting sites in Maine. There are also many more locations where residuals are legally used for agricultural purposes without a site-specific license. The Department has not typically required ground water monitoring at residuals utilization or composting sites. Therefore, actual impacts to ground water from these types of sites have not been widely determined. Ground water monitoring has detected impacts at some sites.

- In the town of Presque Isle, liquid sewage sludge is suspected of contaminating ground water (nitrate) in the vicinity of a sludge storage lagoon. A detailed monitoring plan has been developed and implemented.
- Ground water monitoring at a sludge storage facility in the town of Newcastle showed increased nitrates in downgradient wells, from non-detect to 11.2 ppm; which is above the drinking water standard of 10 ppm. This site has been permanently closed.
- Treated sewage sludge from the Anson-Madison Sanitary District (AMSD) has been used as an ingredient in manufactured topsoil at a gravel pit reclamation site in Sangerville. The results of ground water monitoring at the site indicate that the water chemistry in downgradient wells has been affected by utilization of sludge topsoil. Hardness, calcium, magnesium and alkalinity have increased dramatically in the downgradient wells. Additionally, nitrogen has leached from the manufactured topsoil to ground water. Another obvious impact to ground water was the abrupt, substantial decrease in dissolved oxygen, which was observed in all downgradient wells shortly following the utilization of the manufactured topsoil. The anoxic, reducing ground water environment has resulted in a corresponding increase in the concentrations of iron, manganese and arsenic in downgradient samples. Although the arsenic was likely not generated from the AMSD sludge, but rather from existing sediments and/or parent material at the site, this toxic metal has increased to levels in excess of Maine's drinking water standard, in all downgradient wells.

The University of Maine is conducting a study of potential ground water impacts from the field stacking of sewage sludge. Preliminary results indicate that significant nitrogen is lost, via leachate, from sludge stockpiles after approximately 10 – 14 days of storage.

Table 6-8 Licensed Facilities by Utilization Activity

Type of Utilization Activity	Number of Licensed Facilities
Septage Land Application & Storage	76
Sewage Sludge Land Application & Storage (Class B)	220
Wood-ash & Bio-ash Land Application	223
Other Residual Land Application	75
Composting Facilities	74

Road Salt

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Related Website: (Rules – Chapter 574) www.maine.gov/dep/blwq/574final.pdf

(Sand and Salt Piles) www.maine.gov/dep/blwq/docstand/sandsalt/index.htm

During the winter, more than 100,000 tons of salt are spread on Maine roads for deicing purposes. Today the salt or sand-salt mixes are stored in over 750 registered sand-salt storage piles, two thirds of which are uncovered, a vast improvement over storage just twenty years ago. Leaching of sodium and chloride from uncovered sand-salt storage has caused substantial ground water degradation in Maine. DEP field investigations have documented over 150 drinking water wells in the State that have become unpotable (chloride in excess of 250 mg/L) as a result of contamination from sand-salt storage. Elevated sodium concentrations may pose a health risk for people on sodium-restricted diets, e.g., people with hypertension. For a majority of the population, water will taste salty and household water pumps, hot water heaters, and plumbing fixtures will rust at an accelerated rate if the chloride concentration exceeds the State 250 mg/L secondary (aesthetic) standard.

Nearly every uncovered sand-salt storage pile is assumed to contaminate the ground water downgradient from the source. The impacts range from the Maine Department of Transportation (MDOT) site in Dixfield, where leachate from a sand-salt pile flows a few hundred feet before discharging to the Androscoggin River (where it quickly becomes diluted), to the Town of York's former sand-salt pile and leaky salt storage building that combined to contaminate nine wells and threaten at least 20 other downgradient wells.

An investigation conducted in the Province of New Brunswick, Canada, indicated that as much as 57% of the mass of salt stored may leach annually from uncovered sand-salt storage piles. A British study estimated that approximately 10% of the salt in a typical uncovered sand-salt pile might be lost in one year.

In 1985 and again in 1998, the Maine Legislature directed the DEP to prioritize all known sand-salt storage areas according to the extent of their ground water contamination problems. The priority list is used for the distribution of funds for sand/salt building construction. More than 175 municipal sand/salt storage buildings and 50 MDOT buildings have been constructed, however, continued funding of the program by the Legislature remains uncertain. Nearly 70 towns continue to wait for construction funds as their sand/salt piles continue to impact private water supplies and the environment.

DEP is actively involved with siting of new sand-salt buildings and piles and continues to investigate contamination from sand-salt piles on a case-by-case basis in response to complaints. DEP's Sand-Salt Storage Area Rule (Chapter 574) prohibits siting of new sand-salt storage areas on significant sand and gravel aquifers, within source water protection areas of public water supplies and within 300 feet of a private domestic well. MDOT continues to handle complaints related to sand-salt piles, which they operate, and roads, which they maintain.

A recent trend in winter road maintenance has been a switch by municipalities from using a sand-salt mix to pure salt or liquid calcium chloride, a practice known as "anti-icing." This is being done to improve air quality by eliminating a source of dust, to ease the spring clean-up burden, and to minimize the impact of sand and the pollutants carried by sand into Maine's waterways. Under the new practice where salt is applied under a controlled methodology using pavement temperature sensors, calibrated spreaders, liquid calcium chloride, and a close eye on the timing of the storm event, the amount of sand utilized has dropped by over 80%. However, MDOT files indicate that since 1969 at least 45 wells have been made unpotable by sand-salt spreading on roadways, and MDOT has seen a recent increase in complaints, corresponding with their switch to "anti-icing" practices. Investigations of sand/salt applications in Massachusetts and urbanized areas of Canada have raised concerns that a large percentage of salt can be retained in shallow ground water. The potential result is an increase in chloride and sodium concentrations above the drinking water standards that can persist for many years. The likelihood of this occurring in Maine depends on the volume of applications and conditions within specific ground watersheds. To date, comprehensive studies of sand/salt spreading impacts in specific ground watersheds have not been undertaken in Maine.

Federal Facilities, Superfund and Hazardous Substance Sites

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Related Websites: (Maine DEP Information) www.maine.gov/dep/rwm/rem/index.htm

(Federal EPA Information) www.epa.gov/ebtpages/cleasuperfund.html

There are numerous sites in Maine where hazardous substances have allegedly been discharged into the environment. As of March 2004, the Uncontrolled Hazardous Substance Sites Program (USP) and the Superfund Program together had 93 active uncontrolled hazardous substance/Superfund sites under investigation. This figure is up from 89 sites in the previous reporting period and 43 of these sites are currently in the Operations and Maintenance stage. Five additional locations require further investigation to determine whether they should be listed as uncontrolled sites. The definition of an "uncontrolled hazardous substance site" or "uncontrolled site" is an area or location, whether or not licensed, at which hazardous substances are or were handled or otherwise came to be located. The term includes all contiguous land under the same ownership or control and includes without limitation all structures, appurtenances, improvements, equipment, machinery, containers, tanks and conveyances on the site.

Since 1983, 492 sites have been reported to the Uncontrolled Hazardous Substance Sites Program. Of these, 135 are active (this number includes Pre-Remedial sites and Department of Defense Sites, in addition to USP/Superfund sites), 248 are inactive, 79 are resolved and 30 have been removed from the USP List.

"Inactive Site" means that the USP does not have an interest in the site. There are several reasons a site can be designated "inactive." Examples of reasons for this status include; the site has been investigated and no real or potential threat was found, or after investigation the site was referred to another program. An "inactive" site may become active if new information comes to light indicating a problem, or if, during a file review; information is uncovered that requires further investigation.

"Resolved Site" means that the USP has performed a final review of the site's case history and has signed off on the site. This designation is not meant to confuse, but as an attempt to clarify the site's standing and to provide an additional level of comfort. If a site is inactive, the USP does not consider the site a threat, but DEP has not conducted a case review. This means that, technically, the USP is not finished with the site. If a site is "resolved", USP is finished with it unless new information, indicating a problem, comes to light.

"No Longer Listed Site" means, that as of January 2000, sites are removed from the List once it is determined that they are not “worthy of listing”. This term is used because there are a number of reasons to remove a site from the List, including; no file exists, the site was reported as an oil spill, there is no evidence of a hazardous substance release or based on an investigation the site is referred to another program unrelated to hazardous substance or hazardous waste. Sites are removed on a case-by-case basis.

While a number of the sites are small in terms of the actual source area, many have the potential to impact a large area. Treatment of drinking water and containing the spread of contamination plume are important steps in eliminating or minimizing human exposure to contaminated ground water. However, protecting public health at the tap and/or removing hazardous substances from ground water is expensive. Generally, even under the best of circumstances, long term monitoring is required. For these reasons, USP sites receive a significant amount of the funds available for ground water protection. Hazardous substances that are commonly found in the ground water at these sites include; organic solvents, pesticides, and metals. Many of these chemicals are carcinogenic, mutagenic, and/or teratogenic.

Thirteen sites are listed on the National Priority List of Superfund Sites, including the Brunswick Naval Air Station, the McKin Disposal Site, O'Connor Salvage, the Pinette Salvage Yard, the Union Chemical Site, the Winthrop Landfill, the former Loring Air Force Base, the Portsmouth Naval Shipyard - West Site, How's Corner in the town of Plymouth, the Eastern Surplus Site, the Eastland Mill, and the Saco Municipal Landfill. Recent changes to the list include: the "de-listing" of the Saco Tannery Waste Pits Superfund Site in 1999 and the addition of the Callahan Mine Site (see the Metallic Mining Section of this report for more information on this site) in the town of Brooksville.

For the Uncontrolled Sites Program (including Superfund and Federal Facilities) at least 157 drinking water wells have been contaminated near or above the BRWMs “action level” (one-half the MCLs or MEGs) at 46 uncontrolled sites and at least 312 other wells are at risk. The database for listing wells contaminated at uncontrolled sites, and the source of the above figures, was updated in March of 2004.

Case Study: The Kerramerican Mine and the Blue Hill Mining District

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In 2002, residential sampling conducted as part of the Kerramerican Mine investigation found that a residence adjacent to the site had a water supply contaminated with 26 ppb of cadmium (Maine drinking water standard for cadmium is 3.5 ppb). Tests from neighboring wells were low in cadmium. Because the affected well was hydrologically upgradient from the Kerramerican Mine, the DEP hypothesized that the contamination could be attributed to a source other than the Kerramerican Site.

In response to the discovery, the DHS-Bureau of Health and the DEP decided to look further at other private water wells in the area. In case there was a widespread problem, the agencies wanted residents to know if their water was fit for consumption.

To reach the necessary people, a voluntary mail-in sampling program was devised and implemented. Initially, 36 water-testing kits were sent out and these kits had a return rate of approximately 75 percent. Analytical results indicated that nine wells could potentially be affected by acid mine drainage. However, several results were difficult to make a determination on because of naturally occurring high mineral concentrations. The DEP then expanded the investigation to gain a better understanding of the ground water chemistry in the area. This effort included gathering historical information on other area mines and prospects. DEP also wanted to resample homeowner water supplies whose results indicated potential metals contamination as well as to follow-up with those residents who did not return the initial home water test kits.

The Maine Geological Survey provided information on historical mine locations. This, together with tax maps and topographic information, helped the DEP to define the limit of the Blue Hill Mining District for the purpose of this study. Many abandoned mines were documented in the historical records and today, these areas contain open mine shafts and mine tailings. When these conditions exist, sulfuric acid forms from metal-bearing waste rock and tailings being exposed to air and water. The resulting acidified runoff releases metals including; aluminum, copper, cobalt, manganese, and zinc, allowing them to migrate and impact ground and/or surface water. This phenomenon is known as acid mine drainage, or AMD. Theoretically, the scattered mining areas along with the associated shafts and tailing piles could be sources of the elevated metals found in residential wells.

Next DEP identified properties that appeared to be at risk of ground water contamination due to their proximity to and relative location compared to the locations of abandoned shafts and waste rock piles. A new list of names was compiled to include the additional homes that now fell within the study area as well as homeowners with elevated results from the previous rounds of water testing. Survey forms were sent to homeowners requesting information regarding potential evidence of mining on their properties. If homeowners were interested in participating in the study, they returned a "permission to access property form" to the DEP.

In May 2003, DEP staff explored the mining district area on foot, taking pictures and surveying mine locations with a GPS. Approximately eight open shafts were encountered.

After compiling this information and cross-checking the list of homeowners to sample, DEP visited homes and collected water supply samples. Out of 32 samples collected for this phase, approximately half had elevated levels of metals, most commonly iron and manganese. One cluster of homes had arsenic levels above drinking water guidelines. Elevated levels of cadmium, zinc, copper, iron, manganese and sulfate were seen in the four water supplies suspected of AMD influence. However, because high levels of metals occur naturally in Blue Hill, it is difficult to determine which water supplies are affected and the extent of any affect due to AMD.

At the end of this investigation, participating residents were informed of the results and DEP advised those with high levels of metals to contact water treatment specialists. In addition to old mining activity sites, the investigation documented an extensive amount of waste rock along Route 15/176. This material has been used to build roads, driveways, and culverts and, in some cases, to stabilizing backyard slopes and can be a source of AMD. The DEP determined that this widespread use precluded the practical removal of all potential sources of AMD.

Based on this investigation, the DEP concludes that local ground water is impacted by naturally occurring metals and by AMD resulting from former mining operations. The most practical remedial response is to ensure that residents are aware of the potential problem and are informed of the appropriate precautions available to them. (Please see the Metallic Mining section of this report for more information on this site.)

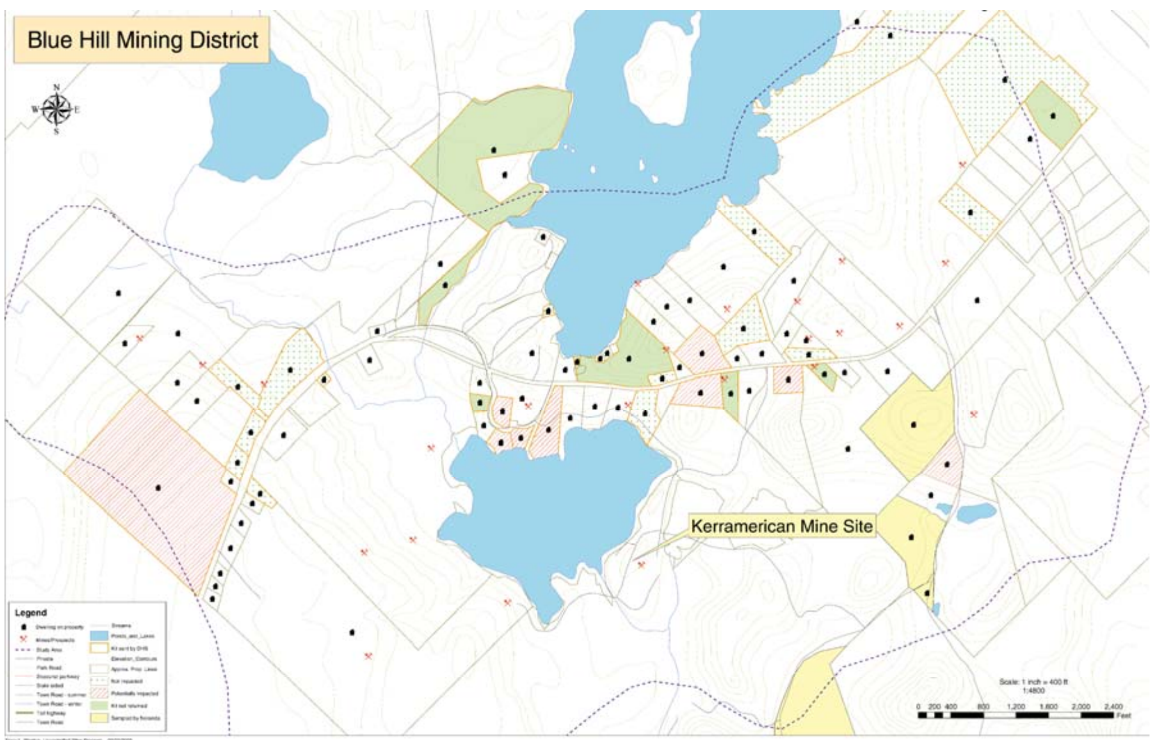

Figure 6-2 Maine's Blue Hill Mining District

Resource Conservation and Recovery Act Sites

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The BRWM lists approximately 780 large quantity hazardous waste generators (defined as producing greater than 100 kilograms per month) that are currently active in the State of Maine. Additionally, there are about 620 inactive large quantity generators listed. Our records also show approximately 6,100 small quantity (less than 100 kilograms per month) generators in the state.

The DEP currently lists approximately 95 sites with non-interim Resource Conservation & Recovery Act (RCRA) licenses and 60 sites with interim licenses. Over 80 sites are under investigation for possible ground water or surface water contamination. Thirty-seven sites listed under RCRA have ground or surface waters that have been contaminated by discharges of hazardous substances. Thirteen of these 37 facilities have ongoing, active remediation. Some examples of ongoing RCRA remediation activities are described below.

Solvent contamination has been found in the Sanford municipal well field; a source of water that serves over 6,500 customers. A number of manufacturing facilities at the nearby Sanford Industrial Park have been investigated and several have known ground water contamination. However, the cause of the well field contamination has yet to be determined.

Chlorinated solvent contamination has been found in the ground water at Masters Machine in the town of Bristol. At least seven wells have been impacted by the pollution; including four wells on the site and at least three offsite residential wells. A "pump and treat" system that has been operating for a number of years appears to be slowly reducing the contaminant levels. Treatment is expected to be necessary for some time to come.

The Ciba Specialty Chemical Company is currently operating a "pump and treat" system at the former Hamblet & Hayes facility located in the city of Lewiston. During the operation of the facility, chemicals were brought in by bulk and repackaged on site. Large amounts of chlorinated and non-chlorinated solvents were released onto the property's soils. A neighboring residence was found to have solvent contamination in the basement, and the house was bought and demolished by Ciba Chemical. Currently, there are high levels of contaminants in both the clayey soils and ground water of the facility property. The pump and treat system is working to prevent the majority of the contamination from moving offsite and into a lower sand and gravel aquifer. Continued monitoring is in place to insure any breakthrough into the lower aquifer is detected, so it may be addressed.

Septic Systems

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Maine is a predominantly rural state, and relies heavily on decentralized sewage facilities for the disposal of human wastes. In June of 1974, the state of Maine adopted a comprehensive set of rules covering the design, siting, permitting, and construction of septic systems, or subsurface wastewater disposal systems. These rules established criteria for site suitability, replaced the percolation test with a soils-based site evaluation, recognized various system components and construction techniques, required the use of a standard design form (HHE-200), and strengthened the system of permitting and inspecting systems at the local level. The rules have evolved over time but retain many of the fundamental principles upon which the 1974 document was based. The most significant changes include the licensing of all individuals who prepare subsurface wastewater disposal system designs and the implementation of a voluntary certification program for system installers. In 2003, the Department developed a voluntary program to allow the inspection of existing systems during real estate transfers.

The Department of Human Services, Bureau of Health, has regulated onsite sewage disposal since 1926. This responsibility rests with DHS because the treatment and disposal of human sanitary waste has been historically considered a public health issue. The Wastewater and Plumbing Control Program within the Division of Health Engineering promulgates and administers the Subsurface Wastewater Disposal Rules and assists local plumbing inspectors when requested. The Program also maintains microfiche copies of all plumbing and subsurface wastewater permits that have been issued statewide from 1974 to the present. During the 2003 fiscal year, the Program processed 13,000 internal plumbing and 10,700 subsurface wastewater permits.

U.S. census data from 1990 indicate that there are in excess of 301,000 septic systems in Maine. Given an 11% increase in the number of households in Maine according to the 2000 census, the number of septic systems has increased to approximately 334,100. Of all the sources with the potential to contribute to ground water contamination, in aggregate, septic systems discharge the largest volume of water to the subsurface environment. Horizontal and vertical separation distances required by the Rules provide for significant treatment of most domestic wastewater constituents within the natural soil mantle.

The major contaminants of concern found in septic system effluent are nitrate, bacteria, and viruses. High concentrations of nitrate may cause methemoglobinemia ("blue-baby syndrome") in infants. Correlation has also been shown between the incidence of stomach cancer and the concentration of nitrate in drinking water. The potential for disease transmission by the surface discharge of bacteria and viruses from malfunctioning septic systems is a significant public health concern.

Nitrates and Septic Systems

Major factors that affect the potential of septic systems to contaminate drinking water are (1) the density of the systems per unit area, (2) hydrogeological conditions and, (3) water well construction and location. Areas with a high septic system density may experience substantial ground water quality degradation partly because of the inability of the systems to adequately treat nitrates. Representative septic system effluent nitrate concentrations vary considerably according to the household lifestyle, diet, and water consumption. Studies have shown that the septic effluent reaching ground water contains approximately 40-80 mg/L nitrate-N. In Maine, estimates of the nitrate concentration from septic systems range from 30-40 mg/L. Ground water quality monitoring conducted jointly by DEP and MGS in 1990 at four Maine septic system leachfields recorded total nitrogen concentrations (as nitrate-N, nitrite-N, and/or ammonia-N) ranging between 27 mg/L and 93 mg/L.

Examination of test data for nitrate-N from private wells in Maine can help identify the threat of conventional septic systems to ground water quality. The earliest ground water quality study performed in Maine to address water quality problems was done in 1973 and involved 523 private wells in York County. The study found nitrate-N concentrations exceeding the 10 mg/L standard in 2% of the wells tested. Approximately 33% of the wells sampled had nitrate-N concentrations in the 1.0 - 9.6 mg/L range. More recent studies have been conducted to document the impact of nitrate on private wells. Data from these studies are summarized in Table 6-9.

The Health and Environmental Testing Laboratory (HETL) database contains the results of water tests done on private wells. These tests are requested by homeowners or state or local officials on behalf of homeowners. This database provides the largest sample of private well nitrate concentrations in the state and includes sites impacted by a variety of nitrate sources including septic systems and agricultural activities. Assuming that the HETL database for nitrate-N represents Maine ground water quality, data from January 2002 to December 2003 indicate slightly more than one half of 1% of private wells in Maine are unpotable because they exceed the 10 mg/L drinking water standard for nitrate-N and approximately 97% have concentrations below 5 mg/L, well below the standard. These percentages have remained steady for the past few reporting cycles.

The 1991 Hancock, Lincoln and Knox County (HLK) study focused on the impact of septic systems, but also examined the influence of agriculture on nitrate concentrations. The HLK study represents rural sites with both modern septic systems (post-1974) and older (pre-1974) septic system designs. The study found that 1.5% of the wells sampled exceeded the 10 mg/L nitrate-N primary drinking water standard. Statistical analysis was performed to identify principal factors affecting nitrate-N concentrations in wells. Results suggest that the highest nitrate-N concentrations would occur in dug wells or driven well points in surficial deposits or bedrock with short casing that are located near agricultural areas or a short distance from septic systems.

The DEP-MGS study focused on residential subdivisions with modern septic systems and associated well siting criteria. Site selection minimized the potential influence of agricultural practices on the ground water. This study, designed to represent modern residential development, demonstrated that ground water impacts with respect to nitrate-N may be expected to make less than 1% of private wells unpotable. Approximately 94% of the test wells were shown to have concentrations below 5 mg/L.

The DEP-MGS study was designed to minimize or exclude agricultural impacts on ground water quality and focus on septic system impacts. The small differences in MCL exeedences may not be significant, depending on the variance and number of samples. In the past, a higher percentage of exceedences in the HETL database were tentatively attributed to people who suspect they have problems with nitrate may tend to test more often, increasing the percentage slightly. In the most recent reporting period, exceedences in the HETL data were less numerous than in the HLK study and about the same as in the DEP-MGS study.

Table 6-9 Nitrate-N Frequency Distributions

Nitrate-N (mg/L)	HETL Database[1] (percent)	HLK Study[2] (percent)	DEP-MGS Study[3] (percent)
0.00 to 2.50	92	85.5	83.8
2.51 to 5.00	6	9.2	10.4
5.01 to 7.50	2	2.5	4.1
7.51 to 10.00	0.4	1.3	1.4
Greater than 10.0	0.6	1.5	0.4
Number of Analyses	**3,638**	**381**	**511**

[1]HETL database for private well analyses between 1/1/02 and 12/31/03.

[2]Cooperative project between the Maine DEP and the Hancock and Lincoln-Knox County Soil and Water Conservation Districts. Project focused on private well testing for nitrate-N in unsewered regions of four towns.

[3]Cooperative project between the Maine DEP and MGS. Project designed to evaluate ground water/well water quality impact of septic systems in 20 residential subdivisions with respect to nitrate-N.

Bacteria

Private well testing for presence of bacteria identifies a greater contamination potential from bacteria than from nitrate. In public and private drinking water supplies, coliform bacteria are used as the indicator of microbial contamination. The Primary Drinking Water Standard for total coliform bacteria is 0 colonies per 100 ml.

HETL data for wells tested between 1960 and 1990 showed approximately 31% of the wells tested for total coliform exceeded the drinking water standard. Data for the period January 2002 to December 2003 indicates that 31% of the 12,958 well samples analyzed for total coliform tested positive. During the same time period, the HETL database indicates 3.2% of the 12,955 wells that were tested for E. coli bacteria tested positive. Twenty-six percent of the wells tested for total coliform bacteria in Hancock County as part of the Hancock/Lincoln-Knox County SWCD study had coliform bacteria. 26% of these wells (7% of the wells tested in Hancock County) also tested positive for fecal coliform bacteria.

Fecal coliform bacteria (and specifically E. coli) originate inside the intestinal tract of mammals. The fecal coliform test is a better indicator of septic system contamination than total coliform because the total coliform test results may be affected by input from non-mammalian sources such as decaying vegetation. Surface water infiltration around poorly sealed well casings, especially dug well casings, may contribute to the disparity between detection of total coliform and fecal coliform. Examination of the HETL database for the period between 1960 and 1990 indicates that 52% of dug wells and 24% of drilled wells tested positive for total coliform bacteria; from January 2002 to December 2003 the HETL database shows 29% of the 1,695 tests done on dug wells and 12% of the 12,220 tests done on drilled wells tested positive for E. coli or total coliform. This lends support to the belief that dug wells are more susceptible to bacterial contamination than drilled wells.

Shallow Well Injection and the Underground Injection Control (UIC) Program

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The underground discharge of pollutants by shallow well injection has been illegal in Maine since 1983 when the State adopted the Federal Underground Injection Control (UIC) regulations. Shallow injection wells in Maine are usually gravity feed, low-technology systems which include dry wells under floor drains, cesspools, septic systems, and infiltration beds. Wastes discharged via injection wells include snow melt and wash water, petroleum products, cleaning solvents and degreasers, storm water runoff, non-contact cooling water, and a variety of other industrial, commercial, and household wastes.

Because of their high ground water contamination potential, the DEP has focused most of the UIC Program efforts on inventorying and eliminating automobile service station and manufacturing facility floor drains. Since 1988, more than 5,200 businesses have been contacted either by mail and/or by on-site inspection to determine the presence of shallow injection wells and the discharge location of floor drains. Other groups targeted for survey and inspection have included: dry cleaners, photo processors, car and truck washes, and auto body shops. Most of these facilities have been required to either seal their floor drains or connect the drains to a municipal sewer system or to holding tanks. Holding tank effluent must often be disposed of at a licensed disposal facility. No ground water quality monitoring has been performed at any of the facilities to assess ground water degradation.

Disposal of hazardous substances through floor drains has led to ground water contamination at many sites, at least two of which are currently classified as uncontrolled hazardous waste sites. Three incidents in 1998 involving floor drains demonstrate their threat to ground water:

- During a weekend, a leaking oil tank at a maintenance garage in Brunswick allowed product to escape through a floor drain and into a ditch outside the building. The leak was not discovered until Monday morning,
- A lobster holding facility in Kennebunk repeatedly allowed small amounts of salt water to enter floor drains that discharged to a septic system, resulting in salt contamination in two nearby residential wells, and
- An auto body shop in Gorham has been linked to contaminants found in at least three wells in a nearby subdivision. Floor drains at the auto body shop discharged to a leaking underground holding tank. As of August 2000, remediation of the site had cost $164,550 and extension of the public water supply to affected homes has cost an additional $254,000. Drinking water monitoring will continue for a minimum of 2-3 years.

In 1998, the focus of the UIC Program shifted from inspections by business sector to a watershed-oriented approach. In the past six years, more than 1,300 Maine businesses have been inspected, with an average non-compliance rate of 33%. The chart below describes activities through the middle of Federal Fiscal Year (FFY) 2004.

Table 6-10 Underground Injection Control Program Inspection Information

General UIC Program Inspection information (Dark Grey Cells Indicate Inspections by Type)										
Federal Fiscal Year	**General Area Covered**	**Towns Included**	**Surveys Mailed**	**Businesses Inspected**	**Routine**	**Complaint**	**Follow-up**	**Total**	**Businesses in Violation**	**Businesses Returned to Compliance**
FFY98	Kennebec	25	**	152	146	6	0	152	39	37
FFY99	Kennebec & Androscoggin	86	**	368	357	11	97	465	76	74
FFY00	Presumpscot & Androscoggin	57	605	313	307	6	53	366	95	94
FFY01	St. John	54	152	168	160	8	129	298	83	78
FFY02	Saco & Piscataqua	35	259	185	178	7	62	247	89	88
FFY03	Mid-Coastal	45	111	172	169	3	116	289	71	71
FFY04	Penobscot			24	23	1	27	51	9	6
Totals		**302**	**1127**	**1382**	**1340**	**42**	**484**	**1868**	**462**	**448**
Statistics:									**33.4%**	**97.0%**

** No surveys were mailed these years.

By emphasizing education, technical assistance and the importance of a business's image within the community, 97% of those businesses have come into compliance within one year of having the violation identified.

Stormwater Infiltration

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Infiltration of stormwater runoff has been practiced in Maine for many years, principally as a means of providing runoff quality control, particularly for phosphorous control from residential developments in lake watersheds. Use of infiltration practices for control of stormwater quantity is, in contrast, a relatively recent practice for large commercial/industrial developments. Infiltration has long been a preferred option for stormwater control at sand and gravel mines, in order to minimize the risk of sediment discharge from those operations. With increasing requirements for quality treatment in a variety of watersheds, more developments are considering infiltration as a stormwater treatment option. In addition to the need to provide treatment for runoff quality and quantity, there are some concerns regarding the impacts of developments with large impervious areas on recharge and baseflow, particularly in small watersheds and watersheds of headwater streams.

Many of the examples and techniques used for stormwater infiltration were developed in areas with warmer climates and deeper soils than are generally found in Maine. The DEP supported a conference, held in Portland in November of 2003, specifically addressing the issues of stormwater management in cold climates; much of the following discussion derives from staff presentations at that conference. To be practical, infiltration systems relying on drywells, open basins, and swales must be able to treat the design volume in a relatively limited time; Maine's stormwater BMPs specify that the system must have drained within seventy-two hours of the storm.

Recharge, particularly in Maine's climate, requires long periods of soil saturation and drainage, and is influenced by climatic factors that cannot be simulated within the constraints of most stormwater-management designs.

The high water table, shallow bedrock, and generally low-permeability soils, common in much of Maine, limit infiltration of large volumes of runoff. The area underlain by high-permeability soils is a relatively small percentage of the state's area. Further limitations arise because many of these areas are too thin and discontinuous to allow for construction of large excavated basins, or are interstratified with finer marine sand and silt strata. Many infiltration systems have failed or have had to be extensively redesigned as a result of failure to account for these lower-permeability layers. Significant slope failures have also resulted from location of infiltration systems close to embankments, particularly when restrictive layers were not identified prior to or during the design phase. If simulation of predevelopment baseflow is determined to be a practical goal, gradual release of stored water from subsurface storage or, where storage in surface waters is an option, from artificial wetlands, may be a more practical option.

The DEP has required ongoing monitoring of certain infiltration systems that have only minimal treatment prior to discharge and serve a commercial/industrial area or other facility with a large connected impervious area. Monitored facilities currently include several commercial developments, including industrial parks and retail developments. A condominium development has recently been required to begin monitoring as well, due to the large amount of impervious area. Small commercial facilities, such as fast-food restaurants, may be able to use skimmer socks or equivalent BMPs in drywells or catch basins if the Department is satisfied with their maintenance procedures. Pretreatment and location requirements are presently being defined more completely in revised stormwater management rules, discussed below.

Adverse impacts on ground water quality have been demonstrated at those sites that are conducting regular ground water monitoring, although the increased pollutant concentrations have only rarely and intermittently exceeded drinking water standards. Typical effects include elevation of chloride, sodium, specific conductance, total dissolved solids (TDS), dissolved organic carbon, and a reduction in both pH and dissolved oxygen. These effects are presumed to indicate primarily contamination with salt from parking lot and road runoff (chloride and sodium together may account for more than two-thirds of the increase in dissolved solids) and the effects of low concentrations of hydrocarbons in this runoff as well. Zinc has been detected in some wells downgradient of infiltration areas, although at highly variable concentrations. This metal is generally a required sampling parameter due to its relatively high mobility and its common occurrence at industrial and commercial sites and in stormwater management systems. Despite the high mobility of zinc, however, five or more years passed at some sites before the metal appeared at the monitoring wells. Frequency of detection generally continues to increase once the first result above MDL is obtained, although the concentration is highly variable. This is consistent with the results of studies in other states, which found frequency of detection to be a more reliable indicator of impact on water quality than instantaneous concentration.

In addition to the increasingly frequent detection of zinc, concentrations of many pollutants, including presumably soluble pollutants such as chloride and TDS, also show both a relatively continuous signal, with minor seasonal variability, and continual increases over ten or more years. That is, although the pollutant is highly soluble, and the pollutant load, as salt usage, traffic, size of connected impervious area or comparable measure, is the same, the concentration of the pollutant continues to increase. Given the travel times to the wells, longitudinal dispersion is not a likely explanation for this progressive increase. This suggests that some fraction of the pollutants may be sequestered in the aquifer as relatively less soluble phases during part of the year, and are mobilized only under certain conditions, likely related to seasonal high ground water. As water level drops, an increasing mass of the pollutant may remain as capillary water or coatings on aquifer particles, mobilized only gradually by any water passing through the unsaturated overburden to reach this zone. Any recharge later in the year may be conducted to the phreatic zone along macropore networks or other zones of high conductivity; so that much of the pollutant mass remains fixed until dissolved during seasonal high water.

For reasons discussed above, stormwater infiltration from large impervious areas must be generally conducted at sites with a high transmissivity. Where the aquifer is sufficiently thick, the effect of localizing runoff in the infiltration basin apparently creates sufficient head to drive the impacted water to depths of 40 feet or more. This is potentially very significant if wells are screened relatively deep in the aquifer in order to reduce the risk of contamination from surface sources.

Surface Impoundments

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Storage, treatment, and disposal of liquid and semi-liquid materials in surface impoundments have long been suspected as major sources of ground water contamination. Currently, the DEP has authority under different statutes (e.g., the UIC Program, Waste Discharge Law, Site Location of Development Law) to regulate a variety of activities and materials related to surface impoundments. In 1979, the DEP conducted a study to characterize and inventory surface impoundments in the State. EPA funded this Surface Impoundment Assessment. Although the inventory probably was incomplete, the study identified at least 173 impoundment sites with a total of 453 individual pits, ponds, and lagoons (both active and abandoned). Materials stored at these sites included municipal sewage, industrial wastewater (including hazardous wastes), and animal wastes.

Since this study was finished, no follow-up work has been performed to complete the initial surface impoundment inventory, to update the inventory with new sites, or to assess the degree of ground water contamination at the various sites. Some of the sites have subsequently been closed and remediated through the RCRA and Uncontrolled Sites Programs. Improperly operated and abandoned sites probably continue to degrade ground water quality today, while some others may not be a threat. A systematic evaluation of all open and abandoned surface impoundments would facilitate a more comprehensive assessment of their ground water impacts. Presently, new facilities proposing to utilize surface impoundments must demonstrate through proper siting and design that there will be no unreasonable adverse effects on ground water quality. These facilities must also conduct ground water quality monitoring, as illustrated in the following section.

Municipal Facilities

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Related Website: www.maine.gov/dep/blwq/engin.htm

During the reporting period between January 2002 and December 2003, a new high-density polyethylene (HDPE) lined lagoon wastewater treatment facility was constructed in the town of Mapleton. This lagoon was built to store and treat wastewater to appropriate water quality standards before it is discharged onto land. During warm weather months, the treated wastewater is discharged via traditional spray irrigation, while snowmaking equipment is utilized to spray the stored wastewater during the winter. The ability to spray treated wastewater year-round provides additional storage capacity for the existing lagoon.

The construction of this facility was authorized by BLWQ, Division of Engineering, Compliance and Technical Assistance, under Section 411 MRSA Title 38. In these types of lagoons, biological treatment of domestic wastewater occurs. Oxygen, which is necessary for the treatment process, is introduced naturally in facultative lagoons or artificially introduced by blowers in aerated lagoons.

As was mentioned above, these new lagoons were constructed using a high-density polyethylene (HDPE) synthetic liner, to prevent leakage. These facilities installed monitoring wells to monitor any leakage that may result in the contamination of ground or surface water. If contaminants are discovered in the monitoring wells, or if excessive leakage is confirmed by other testing (e.g. lagoon underdrain discharge), the lagoon is taken off-line as soon as possible and repaired. Indicator parameters that are monitored may include nitrate-nitrogen, ammonia-nitrogen, TKN, TOC, COD, hardness, pH, chloride, alkalinity and fecal coliform. Metals are also monitored periodically and include arsenic, cadmium, zinc, lead, mercury, selenium, silver and nickel. To date there has been no reported ground water contamination from municipal wastewater treatment lagoons within the State.

Salt-Water Intrusion

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In coastal areas, excessive ground water withdrawals and/or well placements that are too close to the shoreline may lead to saltwater intrusion. This is particularly significant considering that Maine has approximately 3,500 miles of coastline and there are immense development pressures along most of the coast. Saltwater intrusion is particularly common on coastal peninsulas and off-shore islands that rely primarily on private drilled bedrock wells for drinking water. For example, a 1982 hydrogeologic study conducted in the peninsula town of Harpswell found approximately 70 wells that were affected by saltwater intrusion. As development pressure along the Maine coast continues, the incidence of saltwater intrusion is expected to increase.

Metallic Mining

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Related Website: www.maine.gov/dep/blwq/docstand/miningpage.htm

Maine does not have any operating metallic mines at this time. In August of 1991, metallic mining rules were adopted by the State of Maine to be administered by the DEP. The purpose of these rules is to protect land and water quality while allowing for metallic mineral exploration and property development. Currently, no new permit applications are pending. One permit was issued in November 1992 to BHP Utah for advanced exploration. This permit has expired and no activity has taken place.

Historical metallic mining sites such as the Callahan Mine site in Brooksville and the Kerramerican Mine in Blue Hill are known to degrade surface water quality by acid rock drainage from tailings ponds. Both of these sites were mined for copper and zinc, however there are other metals that are found at elevated levels onsite and in the nearby surface water bodies.

The Kerramerican Mine site is currently being investigated by Kerramerican, Inc. which is a potentially responsible party at the site. Kerramerican has agreed to work with the State's Uncontrolled Sites Program to investigate and remediate the property in order to avoid being listed on the National Priorities List (NPL or Superfund). The DEP approved a final Remedial Investigation, which included human health and ecological Risk Assessments in late December 2002. Final approval of the Feasibility Study and the Remedial Action Plan (RAP) await final details pending approval of the wetland permit for the site, which is expected in the spring of this year. Following approval of the RAP, remedial construction by Kerramerican will begin in the summer. Metals found at the site are cadmium, chromium, copper, lead, zinc, iron, and mercury. Additional information on this site can be found in the case study under the earlier section entitled "Federal Facilities, Superfund, and Hazardous Substance Sites."

In the fall of 2000, the U.S. Environmental Protection Agency and the State of Maine completed a Hazard Ranking System (HRS) evaluation for the Callahan Mine in Brooksville. The HRS evaluation concluded that the site is eligible for listing on the NPL. The USEPA proposed the Callahan mine for inclusion on the NPL list in 2001, and EPA listed the site in late 2002.

To date, neither the EPA nor the DEP have conducted remedial investigations at the site. Some homeowner wells near the mine have been sampled and were found to have a low level of metals contamination. At least two homes have elevated levels of zinc and one home has elevated levels of cadmium and lead. No conclusion can be made from these samples without a complete and well-designed remedial investigation. At this point no funding has been allocated by the State or by EPA to do any additional investigations.

Gravel Pits

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Related Website: www.maine.gov/dep/blwq/docstand/miningpage.htm

Five hundred twenty-eight gravel pits 5 acres or greater in size have been licensed by the Maine DEP. The number of unlicensed (illegal) pits that cover 5 or more areas and the number of gravel pits falling below the licensing thresholds are unknown. Recent changes to performance standards now include a variance provision for excavation into ground water. Previously, a separation distance of one to five feet was required between the base of the excavation and the seasonal high water table (SHWT). In general, prior to issuing any variance to excavate gravel from below the SHWT, the Department investigates the dewatering potential for adjacent wells and protected natural resources. The DEP has issued approximately 24 variances to excavate gravel from below the water table. These sites are extensively monitored for both ground water levels and quality. To date, the Department has not observed the direct dewatering of any protected natural resource due to mining from below the water table at these sites.

Impacts to ground water from gravel pit operations include contamination by spillage or spraying of petroleum products in or near the pits, and dewatering of local surficial aquifers. Improper use, storage, or handling of petroleum products is known to have caused ground water contamination in three gravel pits. The State does not have any record of the number of wells or surface water resources such as wetlands adjacent to gravel pits that have been dewatered due to mining activities. Another threat to ground water indirectly related to gravel pits is dumping into pits that do not adequately restrict unauthorized access. Unreclaimed sand and gravel pits are too often the sites of illegal dumping. At the present time, 16 abandoned gravel pits are listed as uncontrolled hazardous waste sites. Ground water in the area of these pits contains a variety of pollutants such as solvents and PCBs.

Radioactive Waste Storage and Disposal Sites

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Related Website: www.maine.gov/dhs/eng/rad/hp_waste.htm

Maine has two high-level radioactive waste generators, Maine Yankee Atomic Power Company (in the process of decommissioning) in Wiscasset and Portsmouth Naval Shipyard in Kittery. The naval shipyard currently ships spent nuclear fuel to interim storage at the Idaho National Engineering Laboratory and its low-level waste to facilities in South Carolina or Utah for burial. The decommissioning of Maine Yankee, as of December 2003, was over 83% complete with about 60% of its wastes shipped. In 2003, waste shipments were over 33,000,000 pounds with a total to date in excess of 160 million pounds.

Maine Yankee stores its high level waste (HLW) on-site and will continue to do so after the decommissioning project is complete. The storage facility for this waste was completed in 2002 and called an Independent Spent Fuel Storage Installation (ISFSI). This installation will house 60 spent fuel casks and 4 casks of Greater Than Class C

Waste (GTCC) generated during Maine Yankee's operation. The entire facility covers about six acres of plant property. A security system and double-fenced enclosure are provided as required by U.S. Nuclear Regulatory Commission (NRC) regulations. In addition, the site is surrounded by an earthen berm. The NRC has strict rules for construction and operation of an ISFSI.

All of Maine Yankee's 64 casks are situated above ground on concrete pads. The transfer of spent fuel from the spent fuel pool to the ISFSI has resulted in 49 casks out of 64 being moved as of December 2003. The U.S. Department of Energy (DOE) is responsible for the ultimate disposal of the spent fuel and GTCC. The ISFSI will provide temporary storage of Maine Yankee's HLW and GTCC until the DOE removes it to a permanent national disposal facility expected to be operational in 2010. The ISFSI will be environmentally monitored as long as waste is in storage. The NRC will continue to regulate the waste as long as it remains on site.

Maine Yankee ships its low-level waste to facilities in South Carolina and Utah for burial. The reactor was shipped to South Carolina in the summer of 2003 for burial. Concrete debris from the plant’s structure and dome make up most of the waste volume to be shipped out of state throughout the remaining decommissioning.

The Maine Department of Human Service’s Radiation Control Program monitors the other generators of low level radioactive waste (LLW) and also inspects their facilities and shipments. Maine's low-level waste generators consist of university and college research facilities, hospitals, research and vendors in the medical field, and a few manufacturing facilities. Most of these sites allow the waste to decay in storage and dispose of it as non-radioactive waste. A small amount of LLW that is not feasible for decay in storage is shipped out-of-state to licensed disposal facilities. On average, twelve out of 132 radioactive material licensees generate LLW that requires out-of-state disposal.

A continuing concern of the State's Radiation Control Program is the discovery of LLW that is appearing at scrap metal recycling yards. Newly installed radiation detection meters have revealed material that makes its way into the waste stream. Typically, these items are consumer items, such as smoke detectors, refuse from nuclear medicine patients and improperly disposed of or naturally occurring radioactive materials (NORM) that have been inadvertently concentrated through other processes. Many other state programs also encounter this problem and efforts are being made to address the issue. Maine has only a couple waste facilities that monitor incoming waste and each year the number of loads triggering alarms increases.

Maine has one confirmed low-level radioactive waste site in Greenbush. Other sites may exist, but they have not been located. Ground water monitoring wells have been installed at the Greenbush site and on adjacent property. No contamination has been detected in the monitoring wells. At this time, threats from chemical contamination are of greater concern than radiological contamination.

Summary of Ground Water Quality

For 2004, DEP has used the statewide 8 digit HUC code watersheds to describe ground water quality (Figure 6-4 depicts these major drainage divides). The three ground watersheds or aquifers that are described below were selected based on the availability of water quality and threats to ground water data. Each watershed includes water quality data for at least one surficial aquifer, and the bedrock aquifer.

Sand and gravel aquifers are often high yield water sources and are often found in developed areas, and are therefore vulnerable to contamination. Bedrock aquifers, though not usually hydrologically connected, underlie the whole state and are mostly used as private water supplies, as are glacial till aquifers. DEP has also added information on raw water quality from a DHS Drinking Water Program (DWP) database to indicate "ambient" water quality. The locations of the wells used to indicate ambient water quality are shown in Figure 6-5 and a summary of the ambient water quality data is in Table 6-11

The ambient ground water quality monitoring network consists of 2,733 public water supplies. A total of 1,445 supplies were used for this analysis. Each of the selected public water supplies is provided by only one source of water: either a drilled well in bedrock; a dug well in glacial till; a drilled well, well point, or dug well in glacial outwash sand and gravel or recent sandy alluvium. Some of the wells are large community water supplies; some are non-transient, non-community water supplies. Analytical results for periodic, routine sampling of raw water were provided by the DWP. Not all the well samples were analyzed for the all the same chemical constituents every time they were obtained: frequency depends on the type of water supply and the population served. Nevertheless, the DEP believes that the selection represents ambient ground water quality in the three major geologic settings that provide ground water in Maine.

Since Maine is early in the process of prioritizing ground water based on use and vulnerability criteria, it is premature to choose specific aquifers based on these criteria. Because of DEPs ongoing efforts at groundwater-threat database management linked with ground water use and vulnerability assessment, the Department hopes to be able to accomplish this type of prioritization during the next round of reporting. Therefore, the examples which follow are an attempt to utilize the format requested by EPA and to assist the Ground Water Program in determining where it can improve data management in order to provide better coverage in the future.

Figure 6-6 shows the locations of the towns discussed in the following section. Figures 6-7, 6-8 & 6-9 and Tables 6-12 through and 6-17 summarize aquifer data and threats to ground water in the selected aquifers. Table 6-18 lists the status of actions being taken to address ground water contaminant problems in these aquifers. This attempt has uncovered three areas that pose a difficulty in reporting information as requested by EPA:

- The data are stored differently (hard copy vs. electronic) and are collected from numerous programs having different sampling reporting periods.
- Aquifer description and setting: private well information from the HETL database does not always clearly identify the source for a well as bedrock or stratified drift.
- The ground water database site information, i.e. type of site, location, owner information, remediation status, etc., are available, but ground water quality monitoring information is not yet accessible for many categories within the database.

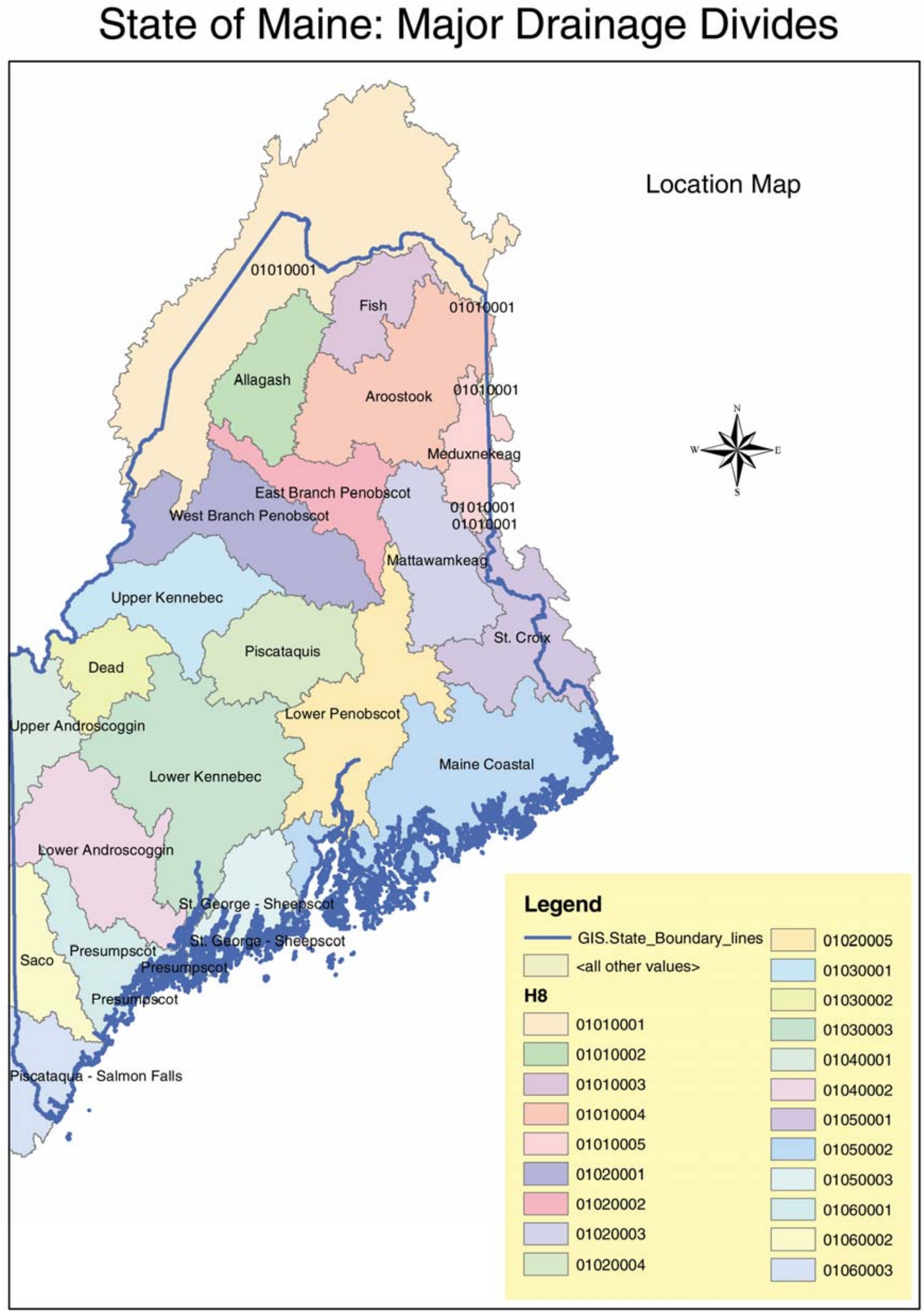

Figure 6-3 Location Map - State of Maine, Major Drainage Divides

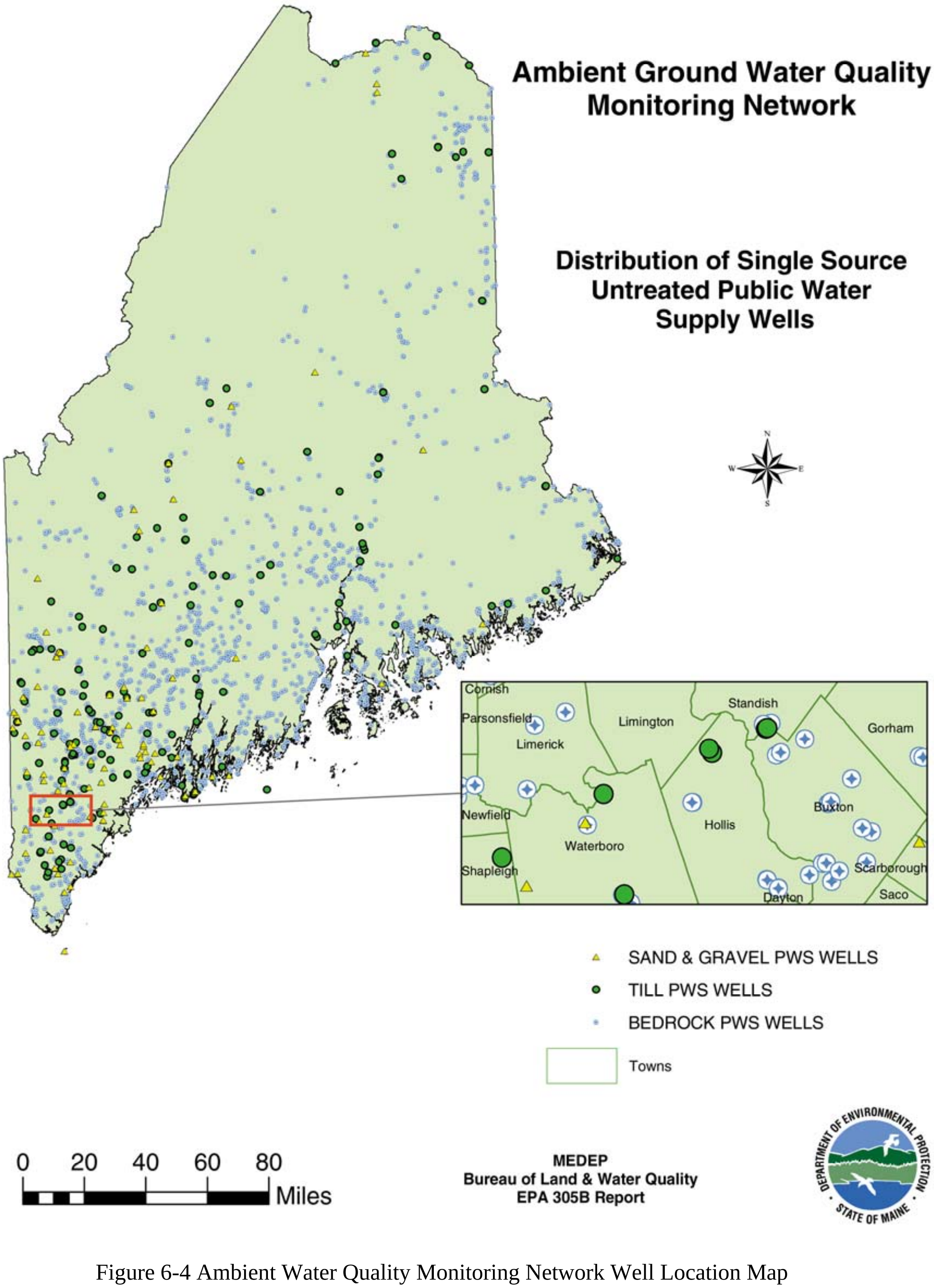

Figure 6-4 Ambient Water Quality Monitoring Network Well Location Map

Table 6-11 Ambient Aquifer Monitoring Data

Ambient Ground Water Quality Monitoring Well Data *

Aquifer Description: Till **Statewide**

Data Reporting Period: Jan. 2002-Dec. 2003

1	Total number of wells used in assessment	Parameter groups	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to ≤5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from >5 to ≤10 mg/l	>10m/l	Parameters are detected at concentrat exceeding MCL'
Ambient (raw) water quality data from public water supply wells	39	VOC	118	0	0	0	0
		SOC	0	0	0	0	0
	# of Tests:	NO3	64	37	0	0	0
	325	Other	70	33	2	1	0

Ambient Ground Water Quality Monitoring Well Data *

Aquifer Description: Bedrock **Statewide**

Data Reporting Period: Jan. 2002-Dec. 2003

Monitoring data type [1]	Total number of wells used in assessment	Parameter groups	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to ≤5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from >5 to ≤10 mg/l	.10m/l	Parameters are detected at concentrations exceeding MCL's
Ambient (raw) water quality data from public water supply wells	1322	VOC	27009	107	14	1	0
		SOC	1972	3	0	1	1
	# of Tests:	NO3	1921	1268	78	19	19
	40120	Other	4385	2112	328	902	12

Major uses of aquifers or hydrologic units: X Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Uses affected by water quality problems: X Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Table 6-11 Ambient Aquifer Monitoring Data (continued)

Ambient Ground Water Quality Monitoring Well Data *

Aquifer Description: Stratified Drift **Data Reporting Period:** Jan. 2002-Dec. 2003
Statewide

1	Total number of wells used in assessment	Parameter groups	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to ≤5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from >5 to ≤10 mg/l	.10m/l	Parameters are detected at concentrat exceeding MCL'
Ambient (raw) water quality data from public water supply wells	84	VOC	2031	0	4	1	0
		SOC	67	0	0	0	0
	# of Tests:	NO3	73	160	7	4	4
	2825	Other	73	0	294	111	0

Major uses of aquifer or hydrologic unit: X Public water supply___ Irrigation___ Commercial___ Mining___ Baseflow X Private water supply ___ Thermoelectric
__ Livestock ___ Industrial___ Maintenance

Uses affected by water quality problems: X Public water supply___ Irrigation___ Commercial___ Mining___ Baseflow X Private water supply ___ Thermoelectric
___ Livestock ___ Industrial___ Maintenance

* data supplied by DHS /BOH/DHE/Drinking Water Program, analysis by DEP/BLWQ/DEA/Environmental Geology Unit

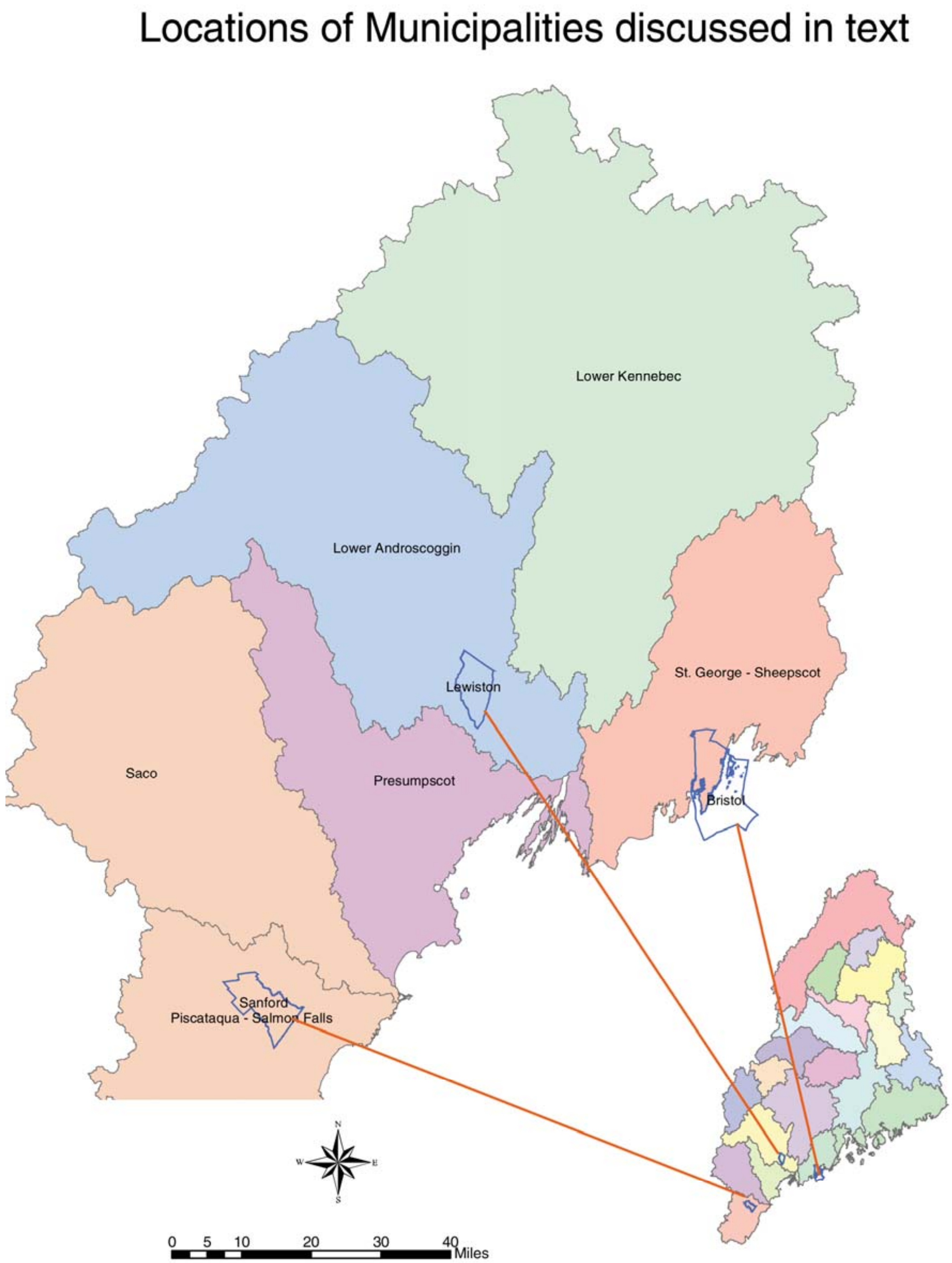

Figure 6-5 Locations of Towns Discussed in the Following Sections

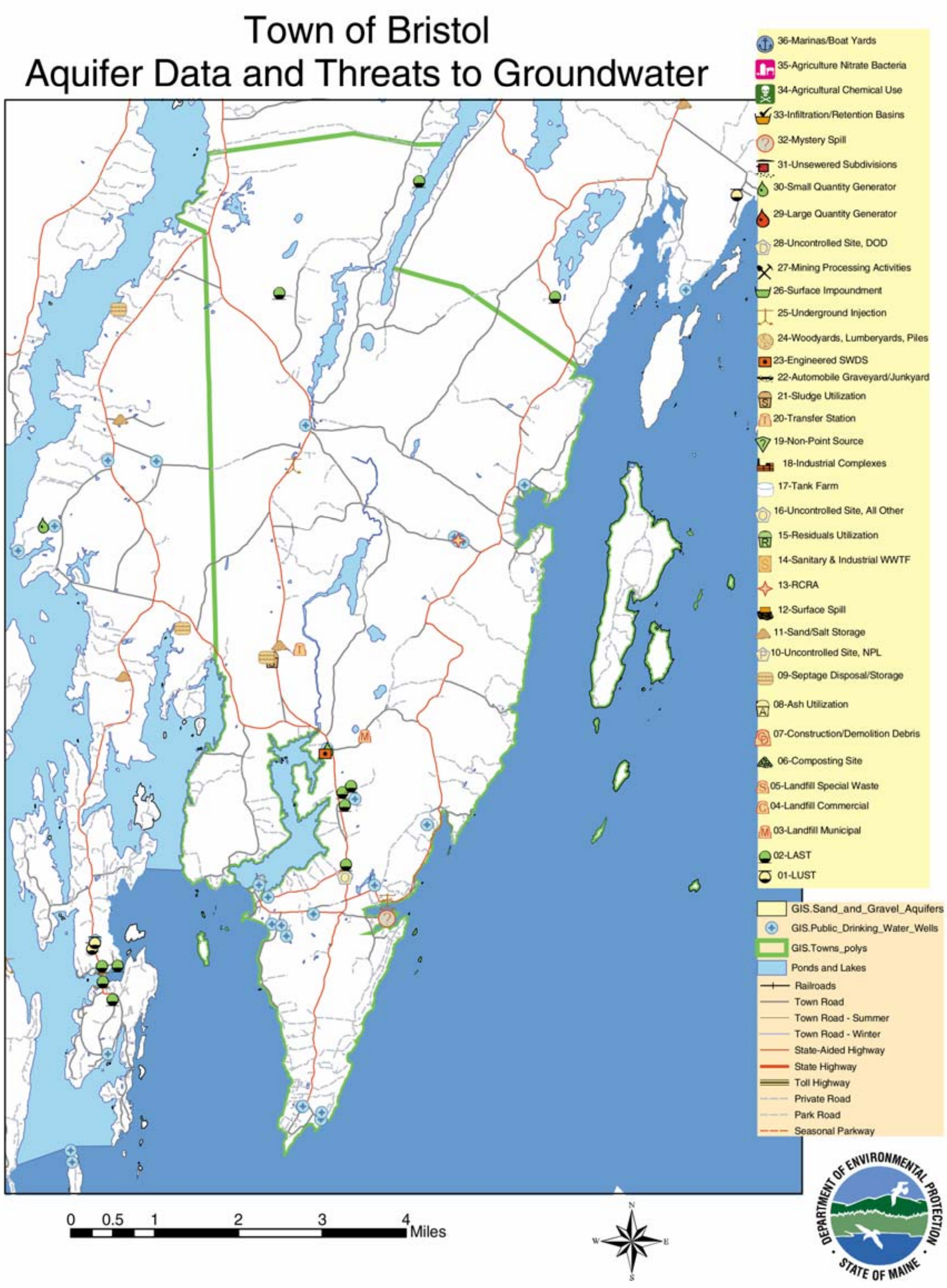

Figure 6-6 Town of Bristol – Aquifer and Threats to Ground Water Data

Table 6-12 Town of Bristol Aquifer Monitoring Data

Aquifer Description: Bristol Bedrock Aquifer **County:** Lincoln
Aquifer Setting: primarily bedrock and till **Data Reporting Period:** Jan. 2002-Dec. 2003

Monitoring	Parameter groups	Total number of wells used in assessment	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	>10m/l	Parameters are detected at concentrations exceeding MCLs
Finished water quality data from public water supply wells	VOC	1	440	1	0	0	0
	SOC	0	0	0	0	0	0
	NO3	2	2	5	0	0	0
	Other	2	45	11	0	0	0
Raw water quality data from private or unregulated wells (Maine Health and Environmental Testing Laboratory)	VOC*	37	0	0	0	0	0
	SOC*	37	0	0	0	0	0
	NO3	37	19	9	1	0	0
	Other	37	35	16	0	0	2
	*No Tests						
Raw water quality data from public water supply wells "ambient" network	VOC	4	548	1	0	0	0
	SOC	0	0	0	0	0	0
	NO3	19	40	9	2	0	0
	Other	20	84	73	3	5	0

Major uses of aquifer or hydrologic unit: X Public water supply; ___ Irrigation; X Commercial; ___ Mining; ___ Baseflow; X Private water supply; ___ Thermoelectric; ___ Livestock; ___ Industrial; ___ Maintenance

Uses affected by water quality problems: X Public water supply; ___ Irrigation; ___ Commercial; ___ Mining; ___ Baseflow; X Private water supply; ___ Thermoelectric; ___ Livestock; ___ Industrial; ___ Maintenance

Table 6-13 Bristol Aquifer Ground Water Contamination Summary

Aquifer Description: Bristol Aquifer
Aquifer Setting: bedrock and till

County: Lincoln
Data Reporting Period: 1985-2003

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL	N									
CERCLIS (non-NPL)	N									
DOD/DOE	N									
UST/LUST	Y/Y	25/5	5	0	Gasoline	5	5	4	0	4
RCRA Corrective Action	Y	1	1	1	TCE, TCA	1	0	0	0	0
Underground Injection	Y	2	0	0	0	0	0	0	0	0
State Sites	Y	1	1	1	TCE	1	1	1	0	1
Nonpoint Sources	N									
Surface Spills	Y	37	37	8	Gasoline	37	37	3	0	3
Above-ground tanks	Y	12	12	7	#2 Fuel oil	12	12	7	0	12
Municipal landfills	Y	1	1	1	Leachate	1	1	1	0	1
De-icing	Y	1	1	1	Salt	1	0	0	0	0
Biomass ash utilization	N	0	0	0	0	0	0	0	0	0
Residuals	N	0	0	0	0	NA	0	0	0	0
TOTALS		60	58	19		58	56	16	0	21

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act
UST - Underground Storage Tanks, Registered
NA- not available

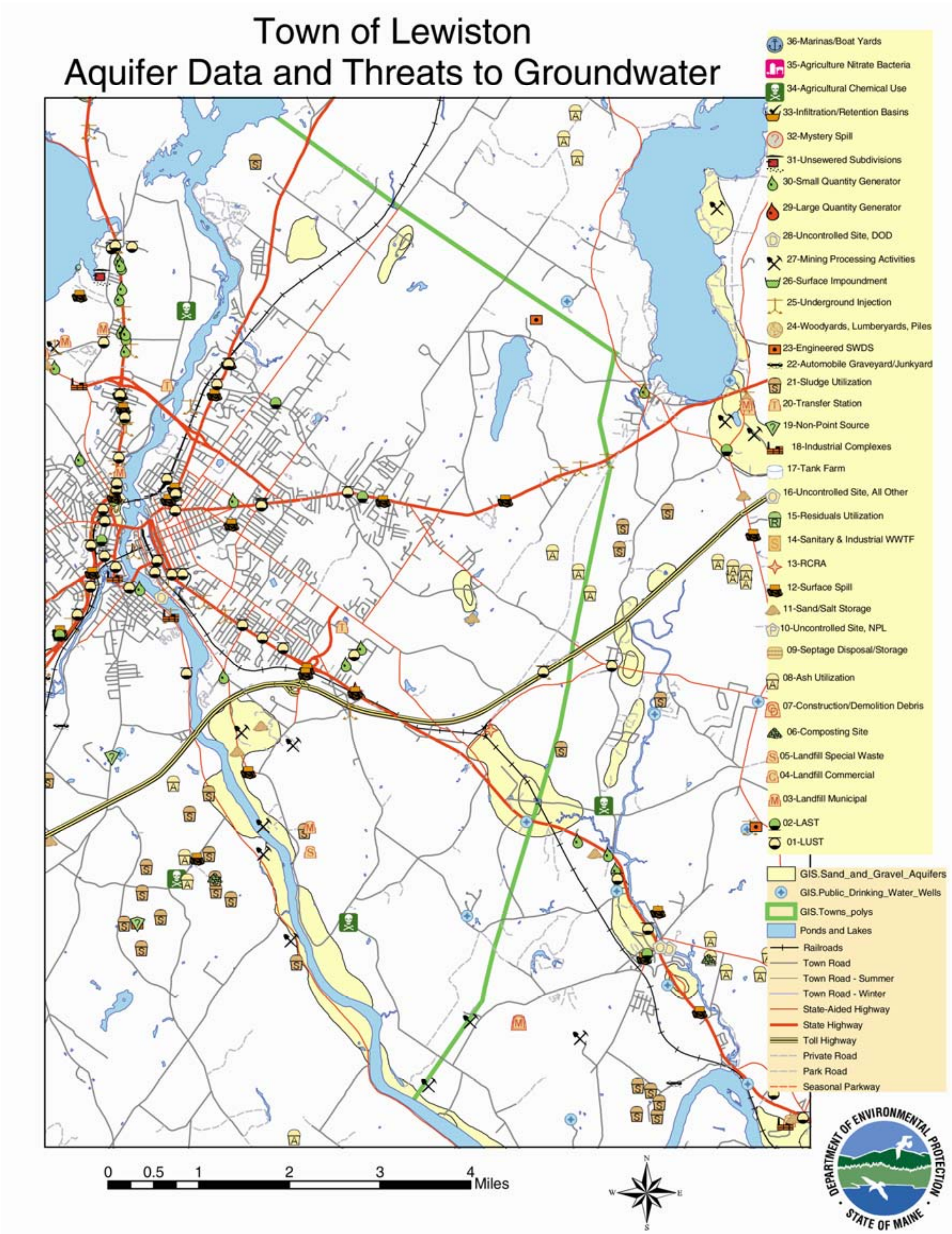

Figure 6-7 Town of Lewiston – Aquifer and Threats to Ground Water Data

Table 6-14 Town of Lewiston Aquifer Monitoring Data

Aquifer Description: Lewiston Bedrock Aquifer **County:** Androscoggin
Aquifer Setting: bedrock **Data Reporting Period:** Jan. 2002-Dec. 2003

Monitoring data type [1]	Parameter groups	Total number of wells used in assessment	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	>10m/l	Parameters are detected at concentrations exceeding MCLs
Finished water*	VOC	0	0	0	0	0	0
quality data	SOC	0	0	0	0	0	0
from public water	NO3	0	0	0	0	0	0
supply wells	Other	0	0	0	0	0	0

***NO FINISHED WATER SAMPLING DONE IN THE REPORTING PERIOD IN LEWISTON**

Raw water quality	VOC	32	205	16	0	0	2
data from private	SOC	32	5	7	0	0	2
or unregulated wells	NO3	32	25	13	0	0	0
(Maine Health and	Other*	32	74	15	0	0	2
Environmental							
Testing Laboratory)	*No Radon testing but 2 results above MCL in Uranium 238 testing (not included in this table)						
Raw water quality	VOC	3	0	0	0	0	0
data from public	SOC	3	0	0	0	0	0
water supply wells	NO3	3	7	6	0	0	0
"ambient" network	Other	3	62	2	3	0	1

Major uses of aquifer or hydrologic unit: X Public water supply ___ Irrigation X Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Uses affected by water quality problems: X Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Table 6-15 Lewiston Aquifer Ground Water Contamination Summary

Aquifer Description: Lewiston Aquifer **County: Androscoggin**
Aquifer Setting: bedrock **Data Reporting Period: 1985-2003**

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL	N									
CERCLIS (non-NPL)	N									
DOD/DOE	N									
UST/LUST	Y/Y	625/25	21	21	Gasoline/diesel	25	21	21	0	21
RCRA Corrective Action	Y	2	2	2	Solvents, mercury	2	2	2	1	1
Underground Injection	NA	NA	0	0		0	0	0	0	0
State Sites	Y	5	5	5	Coal tar etc	5	4	5	1	3
Nonpoint Sources	N	0	0	0		0	0	0	0	0
Surface Spills	Y	12	12	0	Fuel Oil	12	12	0	0	12
Above-ground tanks	Y	97	97	1	#2 Fuel oil	97	97	1	0	1
Municipal landfills	Y	2	1	1	Sludge, Leachate	1	1	1	0	1
De-icing	Y	3	2	2	Salt, sewage	2	2	1	0	1
Biomass ash utilization	Y	2	0	0	0	0	0	0	0	0
Residuals	N	0	0	0	0	0	0	0	0	0
TOTALS		148	140	32		144	139	31	2	45

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act
UST - Underground Storage Tanks, Registered
NA- not available

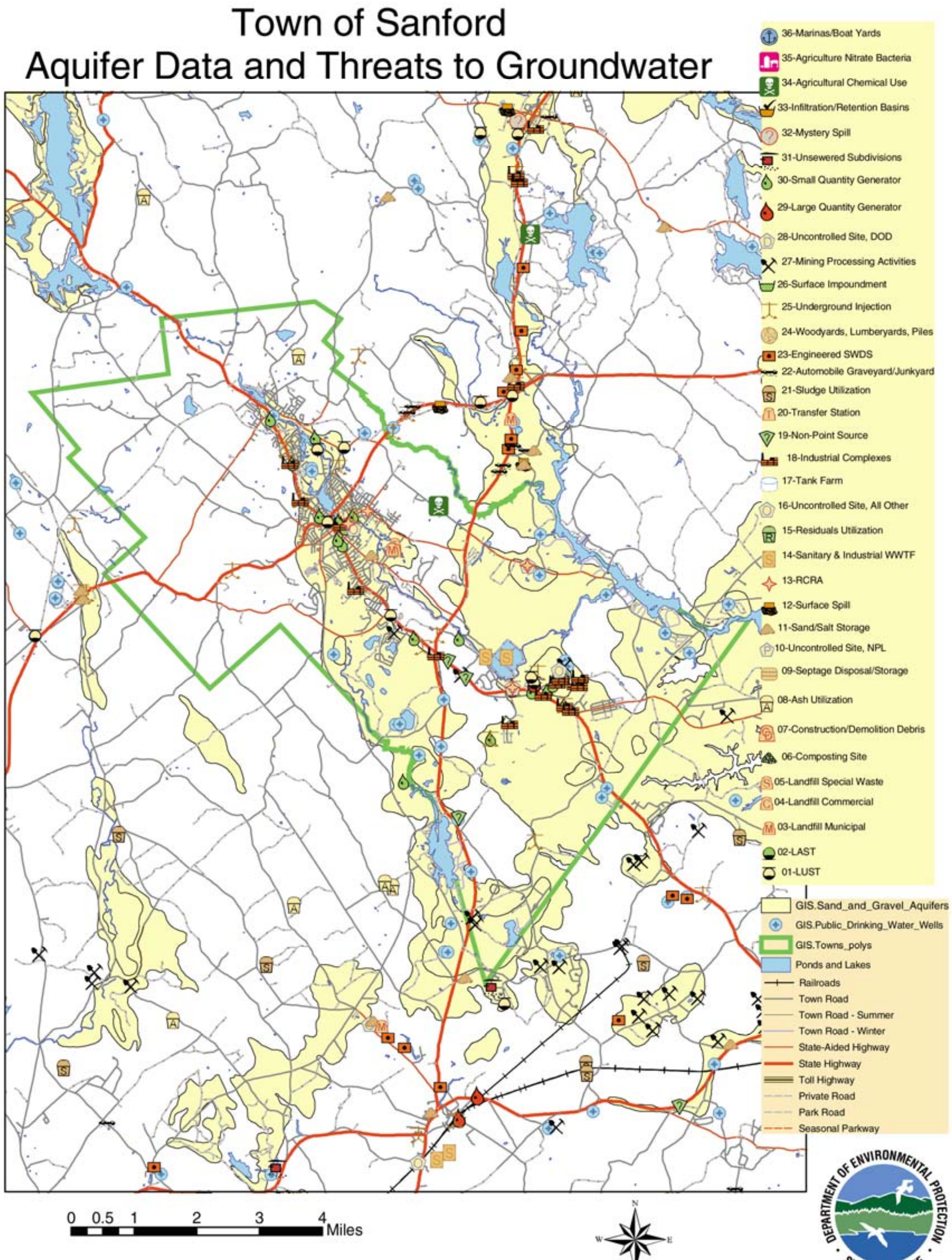

Figure 6-8 Town of Sanford – Aquifer and Threats to Ground Water Data

Table 6-16 Town of Sanford Aquifer Monitoring Data

Aquifer Description: Sanford Bedrock Aquifer **County:** York
Aquifer Setting: primarily bedrock and till **Data Reporting Period:** Jan. 2002-Dec. 2003

Monitoring data type [1]	Parameter groups	Total number of wells used in assessment	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	>10m/l	Parameters are detected at concentrations exceeding MCLs
Finished water quality data from public water supply wells	VOC	2	381	17	8	3	0
	SOC	2	0	0	0	0	0
	NO3	2	4	0	0	0	0
	Other	2	52	2	0	0	0
Raw water quality data from private or unregulated wells (Maine Health and Environmental Testing Laboratory)	VOC	17	1560	78	0	0	0
	SOC*	0	0	0	0	0	0
	NO3	17	14	23	0	0	0
	Other	17	7	14	3	16	6
	*No Tests						
Raw water quality data from public water supply wells "ambient" network	VOC	1	49	0	0	0	0
	SOC	0	0	0	0	0	0
	NO3	11	15	6	0	0	0
	Other	3	2	1	0	0	0

Major uses of aquifer or hydrologic unit: X Public water supply ___ Irrigation X Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Uses affected by water quality problems: X Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Table 6-17 Sanford Aquifer Ground Water Contamination Summary

Aquifer Description: Sanford Aquifer | **County: York**
Aquifer Setting: primarily stratified drift | **Data Reporting Period: 1985-2003**

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL	N									
CERCLIS (non-NPL)	N									
DOD/DOE	N									
UST/LUST	Y/Y	245/57	57	4	Gasoline, fuel oil, diesel	57	57	4	0	4
RCRA Corrective Action	Y	6	6	6	TCE, TCA	10	5	6	1	5
Underground Injection	Y	11	1	1	VOC'S	4	1	1	0	1
State Sites	Y	20	20	20	Oil, metals. Hazardous w.	20	16	3	1	16
Nonpoint Sources	Y	3	0	0		0	0	0	0	0
Surface Spills	Y	3	3	0	Hazardous material	3	3	0	0	3
Above-ground tanks	Y	60	60	6	#2 Fuel oil	60	6	0	0	6
Municipal landfills	Y	2	1	1	Metals, SVOCs	1	1	0	0	1
De-icing	Y	1	0	0	0	0	0	0	0	0
Biomass ash utilization	Y	1	0	0		0	0	0	0	0
Residuals	N	0	0	0	0	NA	0	0	0	0
TOTALS		164	148	38		155	89	103	2	36

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act
UST - Underground Storage Tanks, Registered
NA- not available

Ground Water Prioritization and Vulnerability Assessment

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The DEP and the Maine Geological Survey (MGS) have been developing a model to regionally assess the intrinsic risk to ground water in the bedrock flow system. The model will use parameters such as the measured depth to bedrock and the overburden hydraulic conductivity, as inferred from geologic mapping. The intent is to set regional priorities for state, county, and municipal agencies, and local organizations. Because of the high spatial variability of both controlling factors and the inherent uncertainty in estimates of hydraulic conductivity, the method is not intended to be used for locating specific facilities, but simply to provide a means of estimating relative risk at the watershed scale. The focus of work to date has been on evaluation of intrinsic vulnerability, rather than development of semi-quantitative measures of risk. Work has been concentrated in the watersheds of the Presumpscot, Fore and Royal Rivers and a surrounding 0.5 kilometer buffer area outside of the combined-watershed boundary

Intrinsic vulnerability is a measure of the physical characteristics of an aquifer that make it susceptible to contamination introduced at or near the land surface. It is a function of overburden thickness and surficial geology at specific points of known overburden thickness; the vulnerability at intervening locations is determined by interpolation of these data, and a grid is prepared with a vulnerability factor assigned to each cell. Overburden thickness is obtained from data supplied to the MGS by well drillers, who are required to submit this information for any new water supply well. These point data are not evenly distributed throughout watersheds or throughout the state, and are biased towards those areas of new residential development where a public water supply is not available.

The minimum grid cell size used to date is 100m x 100m. Because the range in possible values of hydraulic conductivity is very large compared to the range in values of overburden thickness, we have developed a relationship between the two that allows hydraulic conductivity to control the vulnerability factor only at relatively small values of overburden thickness. Failure to correct for this problem is a significant oversight in many existing vulnerability assessment techniques, since most of these methods often differ very little from surficial geologic maps. The accuracy of the overburden-thickness grid was tested by selecting a random subset of the data used to generate the grid, gridding the remaining data, and then comparing the interpolated grid-cell values with the known point represented in the grid.

The vulnerability grid was tested using nitrate data from monitored public water supplies within the study area, and by comparison to a statewide study of housing developments with on-site wastewater disposal. It is understood that this procedure self-selects for water quality at sites where nitrate sources may be relatively low, particularly in the case of public water supplies. Consequently, even though the vulnerability at a site might be high, low or non-detect results for nitrate would be expected. Results did show significant correlation between overburden thickness (or casing length, essentially a surrogate for overburden thickness) and nitrate concentration, but not significant correlation between calculated vulnerability rankings and nitrate concentration. Statistically significant correlation was found between low vulnerability rankings at sites with non-detect results and higher vulnerability ratings at those sites with detectable concentrations of nitrate. This may indicate that it is not practical to correlate the contamination risk at a particular point with the calculated vulnerability at that point, but that there is a broad correlation between larger areas of vulnerability and the likelihood of contamination in bedrock. Consequently, there is general validity to the approach, although, as indicated above, confidence in the accuracy of the vulnerability value at any specific cell of a grid is low.

Vulnerability values at particular points may not be very accurate, but the vulnerability across a particular sub-basin may well be, at least for the purposes of comparison with other basins. The agencies are continuing to seek support for refinement of the method and development of a user-friendly application, and for evaluation of other possibly significant factors, such as assessment of recharge - discharge locations in transport of pollutants to and from the bedrock system.

Environmental Groundwater Analysis Database (EGAD)

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A ground water quality database, which links site characteristics and ground water quality information to a spatial database, has been in use at the DEP for the past several years. Maintenance of the database includes identification and location of various activities and known contamination sites, which may affect ground water quality and populations served by public and private water supply wells. This effort is part of a coordinated statewide GIS-linked ground water database project that is used to:

1) achieve understanding of the spatial interrelationships between natural resources and population as they relate to potential or known pollution sources;

2) design clean-up strategies in areas of known contamination;

3) plan development to provide for the protection of public health and safety;

4) assist in prioritizing protection of sensitive ground water and surface water bodies, wetlands, and other environmental resources; and

5) assess the flow and transport interrelationships between surface and ground water quality, in order to evaluate ground water impacts on surface water bodies, and ground water dependent habitat

The Environmental Groundwater Analysis Database (EGAD) is being used to develop a Comprehensive Ground Water Protection Program, and to provide a base dataset of potential threats to ground water quality for the DHS Drinking Water Program (DWP). EGAD is also being used to satisfy requests for water quality data, review applications for safety and practicability submitted under the state's environmental laws, and to evaluate the cumulative impact from multiple sources of pollution.

During the 2002-2003 reporting period, EGAD has seen much use for reporting to other State Agencies (DOT, Dept. of Agriculture, DHS DWP) and non-profit organizations (Project SHARE (for Salmon Habitat And River Enhancement), Maine Rural Waters Association (MWRA)) and consultants, as well as most bureau divisions within the DEP.

Recent EGAD developments and activities include:

- The addition of three more "Site Types" in July 2003 in order to coordinate research and reporting with the DHS Drinking Water Program. These sites are Agricultural Chemical Use, Agricultural Nitrate/Bacteria, and Marinas/Boatyards.
- Identifying and listing sites within each activity category, acquiring basic site, ownership, and spatial data information. The database is now 100% spatially enabled.
- Entering site information into EGAD. At the end of 2003, there were approximately 12,500 records in the 36 "Site Type" categories. During 2002-2003, 2,010 sites were added while many pre-existing sites were either updated or corrected. Some duplicate sites were also deleted.
- A new Oracle “backend”, under development since 1999, was completed in 2003. This new software will allow five formally separate uses of the database to be held in one accessible server location. The “front end” use of the database is also being combined for many different types of uses. The contract to complete this "front end" has been signed and should be completed in 2004.

Fundamental procedures include Site Name and Location data as well as Regulatory information (Licenses, Permits, Spill Numbers, etc.) derived from files and field research. Spatial (GIS) data is obtained either by screen digitizing using "ArcMap" software in association with written directions or maps from files or by collecting site locations via a GPS device in the field. However, fieldwork and GPS data collection is not the typical method because it is subject to limited funding. Geological data, narrative information, and ownership data is included in the database whenever it is available. These Site Data are used to depict spatial relationships, via the ArcMap software, between different GIS data “layers” including; location of public water supply wells, wastewater treatment plants and outlets, monitoring wells, etc. Digital maps can be quickly generated to satisfy the needs of a particular line of inquiry.

Further data gathering and entry of site-specific information includes:

- well design and construction information, and
- sampling and analytical data

There are now over 1,000,000 analyte records contained in the database. During 2002-2003 period, a plan to provide for common formatting of all analyte data received from laboratories to the DEP was developed and implemented. It is now part of an Electronic Data Deliverable (EDD) format in EGAD which a single data "gatekeeper" manages. The common format of the EDD easily and efficiently permits quality control over large amounts of analyte data and associated metadata.

A Quality Assurance Project/Program Plan (QAPP) was drafted in 2000, modified in 2001, and has been reviewed and signed by the users. Hierarchical review of this QAPP is still in progress because it will involve four divisions within the DEP. Quality assurance activities focus on data and location accuracy, consistency in expressing data, and the ability to link related data. The DEP GIS Unit and the Maine Office of GIS (MeGIS) will manage the quality of associated spatial data. Procedures for field location data acquisition via GPS have been and continue to be improved through in-house training and oversight.

Some particular areas involving Site research have included a special project to acquire UIC data (Underground Injection Conduits or floor drains) where a UIC was considered to be a possible source of ground water contamination. This project was begun in June 2001 and continued until June 2002. During that period, 1,369 UICs (out of an estimated 8,000 in existence) were added to EGAD.

In 2002-2003, another special project was initiated to locate and place into EGAD, those Small Quantity Generators (SQGs) which have associated "F" or "P" codes (which means that they generate halogenated and non-halogenated solvents and poisonous chemicals). Although 230 SQG sites were added in this time period, there are still approximately 700 more SQGs listed to add in the future. Overall, there are 4,000 additional SQG (including all chemical types) sites to locate. As of January 2004, a total of 520 SQGs are located in EGAD.

In August 2003, 435 Agricultural Chemical Use Sites were added. These sites came from the Maine Dept. of Agriculture's Board of Pesticide Control. Analyte data from private wells is included and greatly increases access to water quality assessment throughout the State.

A significant effort was made in 2002-2003 to improve the amount and quality of regulatory identification codes. The result has been a plan and a prototype whereby the regulatory data (licensing, permits, etc) has been expanded from only 4 fields in EGAD up to 15 fields. These additional fields will permit direct linking to other electronic databases and significantly reduce research time for those seeking more site data.

The individual site types as of January 2004 include:

Agricultural Chemical Use and Storage	RCRA Remediation Sites
Agricultural Nitrate/Bacteria	Sand/Salt Storage Sites
Ash Utilization Sites	Sanitary and Industrial Wastewater Treatment Facilities
Automobile Graveyards	Septage Storage and Disposal Sites
Commercial Landfills	Sludge Utilization Sites
Compost Facilities	Small Quantity Generators
Construction/Demolition Debris Disposal Sites	Solid Waste Transfer Stations
Engineered Subsurface Wastewater Disposal Systems (> 2000 gallons per day)	Special Waste Landfills
Industrial Parks	Surface Impoundments
Large Quantity Generators	Surface Petroleum Spills
LAST Sites	Tank Farms and other bulk storage facilities
LUST Sites	Transfer Stations
Marinas/Boatyards	Uncontrolled Sites – Dept. of Defense
Municipal Landfills	Uncontrolled Sites- State Sites
Mystery Spills	Uncontrolled Sites- Superfund
Nonpoint Sources (highways, golf courses, etc.)	Underground Injection Wells
Residuals Utilization Sites	Unsewered Subdivisions
Resource Extraction	Woodyards, Lumberyards and Biomass Fuel Piles

Ground Water Quality Trends

Maine's complex hydrogeologic setting makes representative ground water quality sampling difficult. The hilly topography, complex geology, and generally shallow water table have created numerous localized ground water flow basins, "ground watersheds", which are similar to and often coincide with surface watersheds. As a result, water quality data obtained from monitoring wells indicate only the water quality at a specific location and depth in an aquifer. These data reflect the ground water quality in the immediate vicinity of the monitoring well, but they are not indicators of ground water quality elsewhere, either inside or outside a particular "ground watershed". Current information about State ground water contamination problems may not describe the actual situation as much as it reflects the reason for the investigation and the manner in which it is conducted, i.e., the contaminants tested for, where the monitoring occurred, and how it was performed.

New occurrences of ground water contamination are documented in Maine each year. Although discovery of existing contamination is expected to continue, future reports of contamination are expected to decline substantially as the State's ground water protection initiatives continue to be implemented. These programs stress contamination prevention rather than remediation. Key aspects of these programs include:

1. Stricter underground storage tank installation and monitoring standards, removal of old and substandard tanks, and registration of all active and abandoned tanks should continue to reduce discharges from underground storage tanks.

2. In light of the increasing number of AST-related ground water threats, better tank standards and a statewide spill protection program have been developed to protect ground water; also, continuing outreach is needed to make the public aware of the threats from weather and overhead dangers to home heating oil ASTs.

3. Continued development and implementation of strategies to protect ground water from agricultural chemicals will diminish the impact of pesticides and fertilizers on ground water quality.

4. Implementation of manure application guidelines reflecting agronomic nutrient utilization rates will decrease the adverse impact of poultry and dairy farms on ground water quality.

5. Final closure of older, polluting landfills will reduce one of the most prominent sources of contamination in the State. Further emphasis on recycling would reduce the waste stream and decrease landfill capacity needs. The DEP and Sate Planning Office have taken over some of the waste reduction and recycling related programs formerly conducted by the disbanded Maine Waste Management Agency.

6. Storing sand-salt mixtures for road maintenance in watertight storage buildings will prevent highly concentrated salty leachate from contaminating ground water. However, this solution is still years away from full implementation. Elevated concentrations of sodium and chloride will increase in the ground water adjacent to roadsides due to a shift away from sand-salt mixtures until an economical and environmentally suitable substitute for sodium chloride can be found.

7. The emphasis of the UIC Program on inventory and elimination or control of shallow injection wells will undoubtedly aid ground water protection efforts. Although the extent of contamination from shallow well injection in Maine is unknown, studies in other states indicate serious ground water quality impacts resulting from routine and accidental discharges of toxic and hazardous substances.

8. The Maine Nonpoint Source Pollution Program will have the greatest impact in reducing ground water contamination. The program develops best management practices (BMPs) for activities contributing to nonpoint source pollution. Despite the paucity of data to quantify the extent of ground water contamination from many of those sources, the deleterious ground water quality impacts from many of the activities are well documented, and studies are underway to fill the existing data gaps. Development of BMPs for those activities can proceed concurrently with ground water monitoring. Developing public awareness of BMPs is one of the most important aspects of the Nonpoint Source Pollution Program.

9. The Maine Geological Survey (MGS) has an ongoing program to survey the ambient water quality of bedrock wells as an extension of the Bedrock Ground Water Resources basic data program. This program is based on well driller information submitted from new well installations all around the state. This will continue to add to our rather limited knowledge of ambient ground water quality.

10. Recent changes to Site Location of Development Act strengthen erosion and sedimentation control and stormwater management, and place emphasis on defining and protecting sensitive watersheds. These changes may help protect drinking water quality in developed areas of the State.

11. The Environmental Groundwater Analysis Database (EGAD), is an ongoing program to geographically locate and provide a database of potential threats to ground water quality. EGAD is being used to satisfy requests for water quality data, review applications submitted under the state's environmental laws for safety and practicability, and to evaluate cumulative impacts to ground water. It is also useful for source water protection in both the public and private sectors. EGAD is also useful in planning future development and in protecting vital natural resources. By continuing to support expansion of this database, the large amounts of data generated in remediating and investigating ground water contamination incidents will be made more widely accessible and useful.

Section 6-3 OVERVIEW OF STATE GROUND WATER PROTECTION PROGRAMS

Background

The protection of Maine ground water is an issue of concern at the local, regional, state and federal levels. In 1989, the State adopted the Maine Ground Water Management Strategy to articulate its ground water protection policy. In 1990, the State also formulated its Nonpoint Source Pollution Management Plan. This plan identifies the major sources of nonpoint source pollution to Maine's ground water and surface water and proposes to implement pollution prevention programs.

Serious ground water pollution problems that have occurred throughout the State and elsewhere have heightened the need for protecting ground water supplies. A few municipalities and regional planning agencies have conducted ground water quality assessment studies, but programs for effective assessment of the quality of ground water resources are needed in many areas of the State. Maine's ground water protection program (Table 6-18) emphasizes three areas of effort:

1. State interagency coordination of ground water programs;

2. Assessment of ground water protection problems, including enhancement of the Environmental Groundwater Assessment Database; and

3. Statutory changes and building upon implemented state ground water protection programs to increase ground water protection and risk reduction.

Table 6-18 Summary of State Ground Water Protection Programs

Programs or Activities	Check (X)	Implementation Status	Responsible State Agency
Active SARA Title III Program		Authority not delegated	
Ambient ground water monitoring system	x	Continuing efforts	MGS, USGS
Aquifer vulnerability assessment	x	Continuing efforts	DHS
Aquifer mapping	x	Stratified drift in progress	MGS
Aquifer characterization	x	Stratified drift in progress	MGS
Comprehensive data management system	x	under development	DEP, DHS, MGS
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)	x	under development	DEP
Ground water discharge permits	x	Continuing efforts	DEP
Ground water Best Management Practices	x	Continuing efforts	DHS
Ground water legislation	x	Continuing efforts	DHS
Ground water classification	x	fully established	DEP
Ground water quality standards	x	Continuing efforts	DHS
Interagency coordination for ground water protection initiatives	x	Continuing efforts	DEP, DHS, MGS, DOT, DOA
Nonpoint source controls	x	under development	DEP
Pesticide State Management Plan	x	Generic plan completed, revised in 1998	BPC
Pollution Prevention Program	x	fully established	DEP
Resource Conservation and Recovery Act (RCRA) Primacy	x	fully established	DEP
State Superfund	x	fully established	DEP
State RCRA Program incorporating more stringent requirements than RCRA Primacy	N/A		
State septic system regulations	x	fully established	DHS
Underground storage tank installation requirements	x	fully established	DEP
Underground Storage Tank Remediation Fund	x	fully established	DEP
Underground Storage Tank Permit Program	x	fully established	DEP
Underground Injection Control Program	x	fully established	DEP
Vulnerability assessment for drinking water/wellhead protection	x	Continuing efforts	DHS
Well abandonment regulations	N/A		
Wellhead Protection Program (EPA-approved)	x	fully established	DHS
Well installation regulations	x	fully established	DHS, MGS

N/A means "Not Applicable"

Ground Water – Surface Water Interaction

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As noted elsewhere in this report, stormwater infiltration is sometimes considered as part of an effort to mitigate the effects of construction of large developments on recharge volumes. However, assuming that the major impact on recharge is due mainly to a relatively small number of large developments in a watershed may ignore more significant changes in recharge throughout the watershed that are the result of shifts in land-use. These "more significant changes" may include such items as alteration of wetlands, change in land cover type, compaction of soils, and topographic changes. To date, the DEP has not performed a systematic assessment of recharge changes in large watersheds to determine the relative significance of development on recharge. The need for such an assessment, in at least some areas of the state, is anticipated in the relatively near future. DEP staff are currently studying methods of estimating recharge and evaluating sustainable yield that are used in other areas, as part of possible future development and implementation of a similar method for Maine.

Given recent drought conditions, more consideration has been given to assessing the impacts of ground water withdrawal on baseflow and water levels in surface waters. Detailed monitoring results are available from a small number of facilities required to monitor ground water and surface water levels due to the volume of ground water extracted. These are principally water bottlers and facilities with large irrigation wells or cooling water wells. Because Maine does not have a regulatory threshold for ground water withdrawal, not all high-volume ground water users are required to conduct ground water or surface water monitoring. Only those facilities that are physically large enough to be subject to Maine's Site Location of Development Act and conduct extraction of large volume of ground water are required to conduct monitoring of water levels to measure the impacts of that withdrawal. In addition, the MGS reviews monitoring information and ground water use studies for some large agricultural projects in areas of the state that are outside of DEP jurisdiction.

Water Withdrawal Reporting Program: In 2002, state law established a Water Withdrawal Reporting Program that requires annual reporting of water withdrawals that exceed specified thresholds. The first reporting year began October 1, 2002 and the first annual report of the new program was issued in January 2004. For ground water, reporting withdrawals of over 50,000 gallons in one day is required. The law does not require use of water meters, so the reporting function will allow quantities to be estimated or reported as ranges. Certain uses, such as non-consumptive uses, household uses, public water systems, water users already subject to reporting requirements, public emergencies such as fire suppression, and transfer of water to storage ponds are exempted from the reporting requirements, provided that the users file a notice of intent indicating their intention to be covered by NOI provisions. This statute also requires the Department to develop rules for "maintaining in-stream flows and GPA water levels that are protective of aquatic life and other uses and that establish criteria for designating watersheds most at risk from cumulative water use". These will be major substantive rules, and must be submitted to the Legislature for consideration in 2005. The standards for in-stream flows are to be based on the natural variation of flows and water levels, and are to allow for variances if use will still be protective of water quality.

Proposed Statutory Changes

NPDES Phase II Stormwater Requirements and the Underground Injection Control Program

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Related Website: Note – after clicking on the URL, scroll down to Appendix "D" on Page 37
www.maine.gov/dep/blwq/docstand/stormwater/group/500textweb2E05_12_04compiled.pdf

Work is ongoing to mesh NPDES Phase II stormwater requirements and the Underground Injection Control Program (UIC) with Maine's Stormwater Management Program. EPA's definitions for wells and subsurface fluid distribution systems do not cover sumps, retention basins, dry swales, or several other infiltration practices that are relatively common in Maine, leaving a gap in the UIC Program that must be covered by the stormwater law. However, because of the minimum area thresholds for regulation of facilities under Maine's stormwater program and in NPDES Stormwater Phase II, not all sites with dry wells or subsurface fluid distribution systems will necessarily receive the additional level of review required for those permits. Infiltration systems qualifying as underground injection wells are currently required only to register with the UIC Program.

Maine’s Waste Discharge Law does not currently allow approval of subsurface discharges under license-by-rule procedures. Rules for infiltration structures, both those which do and do not qualify as underground injection wells, are being revised and expanded as part of a major revision of the stormwater program. The DEP will be proposing a minor statutory change that would grant a license-by-rule authority under the Waste Discharge Law to stormwater injection wells that meet the standards of the new stormwater rules. These wells would still be required to register separately with the UIC Program, as would wells for facilities smaller than the thresholds of the stormwater program. Stormwater wells that cannot meet the standards of the revised stormwater rules are not necessarily prohibited but they would need to apply for an individual waste discharge license.